

INTEGRATED NATIONAL ENERGY AND CLIMATE PLAN

Ministry of Economic Development

*Ministry of the Environment and
Protection of Natural Resources and the Sea*

Ministry of Infrastructure and Transport

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PART 1 – GENERAL FRAMEWORK

SECTION A: NATIONAL PLAN

1 OVERVIEW AND PROCESS FOR ESTABLISHING THE PLAN

1.1 Overview

i. Political, economic, environmental, and social context of the plan

For some time, Italy has been working towards ensuring the widest possible use of instruments that, together, serve to enhance energy security, environmental protection and the affordability of energy, thus contributing to European objectives relating to energy and environment.

Italy is fully aware of the potential benefits inherent to the increased availability of renewables and energy efficiency, connected to the reduction in polluting and climate-changing emissions, improvements in energy security, and economic and employment opportunities for families and for the production system, and intends to follow this path with conviction, with an approach that increasingly focuses on citizens, including in their capacity as prosumers, and businesses, in particular small and medium-sized enterprises. This development will be guided by a constant focus on efficiency and facilitated by cost reductions for some renewable technologies, including photovoltaics, which will take on growing significance due to their modularity and the fact that they use a source that is widely available.

Italy therefore agrees with the Community approach, which is intended to strengthen commitment to the decarbonisation dimension, and aims to promote a Green New Deal, understood as a green covenant with businesses and citizens that views the environment as the country's economic driver. The Green New Deal will be expressed in different forms and follow different directions, including provisions to transpose the EU Directives implementing the energy and climate package, but also by promoting new and synergistic initiatives, starting with Law No 160 of 27 December 2019 (Budget Law for 2020).

In the course of this agreed and consolidated strategic process, due consideration will be given to aspects of economic and social sustainability, and to compatibility with other environmental protection objectives. The recent provision contained in Law No 141 of 12 December 2019, which converted Decree-Law No 111 of 14 October 2019 concerning the transformation of the

Interministerial Committee for Economic Planning (CIPE) into the Interministerial Committee for Sustainable Development (CIPESS), follows the objectives set out in the Green New Deal. Its declared purpose is to foster closer coordination of public policies with a view to pursuing the sustainable development objectives set out by Resolution A/70/L.1, which was adopted by the United Nations General Assembly on 25 September 2015.

As regards the economic and social sustainability of the energy transition, in the last 10 years charges to support renewable energies and energy efficiency have increased significantly: taking just those incentives covered by tariffs, these have risen from approximately €3.5 billion in 2009 to €14.1 billion in 2017, to then fall to €13.3 billion in 2018.

The combination of the economic crisis with the increasing cost to support renewable energies and energy efficiency has created a greater vulnerability, meaning that the sustainability of the energy system, including from an environmental perspective, must be sought with due care and attention to the economic impacts on consumers, a proportion of whom, moreover, find themselves living in conditions of more than just energy poverty, and are in need of protection. On the other hand, the energy (gas, fuel and electricity) costs paid by businesses often point to a positive spread with respect to the European average (above all for SMEs), and this represents a further reason to adopt an approach that is very mindful of the costs of energy transition.

In addition, due care will be paid to ensuring that the energy and climate objectives are compatible with the objectives relating to landscape protection, the quality of air and water bodies, the safeguarding of biodiversity and soil protection. Those measures necessary for the increasing decarbonisation of the system require plants and infrastructure that may have environmental impacts. If, on the one hand, the impacts of some of these measures may be mitigated – for example by promoting the incorporation of photovoltaics into already built-up areas or areas unsuitable for other uses – on the other hand the stability of the energy system additionally requires, at least in the mid-term, a range of physical infrastructure, the construction of which will stimulate forms of dialogue and cooperation between territories.

The process aimed at establishing the mix of solutions and instruments that is most compatible with the objectives of the 2030 Energy and Climate Plan and other requirements, including those relating to environmental impacts, has involved various interlocutors. This is thanks not least to the public consultation and the strategic environmental assessment conducted on the draft Integrated National Energy and Climate Plan (INECP) sent to the European Commission in late 2018.

The widespread adherence by citizens and businesses to the instruments for promoting distributed generation and energy efficiency suggest that the support policies in these areas may be able to continue, paying particular attention to minimising costs. As mentioned above, however, various forms of participation will also be required for the construction of large plants (supplemental to the plants for distributed generation, but still necessary) and the remaining physical infrastructure so as to ensure that the measures are implemented in an orderly and timely manner, in compliance with the process for achieving the objectives.

Innovation in terms of policies for the decarbonisation of the energy sector, developed with due regard for other issues to which citizens and businesses are sensitive, has a sufficient degree of support, as also emerges from the public consultation. That support may be strengthened by measures designed to protect the most vulnerable sections of the population, with a particular focus on energy efficiency and distributed generation from renewable sources. The arrangements for doing so would help ensure that the benefits of the energy transition are passed on to consumer citizens and businesses.

ii. Strategy relating to the five dimensions of the Energy Union

This plan is intended to contribute to a wide-ranging transformation of the economy. In this, the combination of decarbonisation, the circular economy, efficiency and the rational and fair use of natural resources represent objectives and instruments for an economy that is more respectful of people and the environment. The framework is one of integration of the national energy markets in the Single Market and due consideration for affordable pricing and security of supply.

Italy therefore agrees with the approach proposed by the Governance Regulation, which opts for an organic and synergic strategy for the five dimensions of energy.

The general objectives sought by Italy are essentially the following.

- a) Accelerate the decarbonisation process by setting 2030 as an interim milestone for achieving full decarbonisation of the energy sector by 2050 and integrating environmental factors in other public policies.
- b) Place a central emphasis on citizens and businesses (in particular SMEs), in such a way that they become key players and beneficiaries of the energy transition and not just the financiers of active policies. This requires the promotion of self-consumption and renewable energy communities, but also the greatest possible degree of regulation and transparency of the sales segment, so that consumers may reap the benefits of a competitive market.
- c) Foster the evolution of the energy system, particularly in the electricity sector, from a centralised structure to a distribution predominantly reliant on renewable sources,
- d) Adopt measures to improve the capacity of renewables to contribute to security while at the same time promoting frameworks, infrastructure and market rules which, in turn, contribute to the integration of renewables.
- e) Continue to ensure adequate supplies from conventional sources, by pursuing security and continuity of supply, with the understanding that the demand for these conventional sources is in progressive decline as a result of both the increase in renewables and energy efficiency.
- f) Promote energy efficiency across all sectors as an instrument for protecting the environment, improving energy security and reducing energy costs for families and businesses.
- g) Promote electrification of consumption, in particular in the civil and transport sectors, as an instrument for additionally improving air and environmental quality.
- h) Guide the evolution of the energy system through research and innovation activities to develop, in line with European guidelines and the requirements for full decarbonisation, solutions able to achieve sustainability, security, continuity and cost effectiveness of supply based increasingly on renewable energy in all usage sectors. Another goal to encourage the reorientation of the production system towards processes and products with a small carbon footprint, which may also be of benefit to the demand arising from other support measures.
- i) Adopt, taking into account the conclusions of the strategic environmental assessment (sea) and related environmental monitoring, measures and expedients to reduce the potential negative impacts of energy transition on other equally relevant objectives, such as the quality of air and bodies of water, the limitation of soil consumption and landscape protection.
- j) Continue the process for integrating the national energy system with the energy union.

The pursuit of these general objectives requires the adoption of horizontal policies and measures to supplement the sector-specific measures outlined in Chapter 3, which, in turn, must be coordinated and structured so as to be coherent with not just the specific objectives, but also the general objectives outlined above.

The horizontal measures will include the following.

- Careful governance of the plan that will enable it to be implemented in a coordinated manner and which ensures uniformity of action, in particular in terms of the timeframes and processes for authorising and building physical infrastructure, the coordination of research and innovation activities, and, more generally, the monitoring of the effects of the plan in terms of the reorientation of the production system, and of costs and benefits. In light of the cross-cutting nature of the plan, which affects the tasks and remits of many State administrations, and the system of competences established by the Italian Constitution, this governance will encompass various ministries. It will also involve, in accordance with their respective roles, the Regions, the municipalities and the Regulatory Authority for Energy, Networks and Environment (ARERA), with the possibility of including representatives from the research sector and business associations and workers' organisations. An important prerequisite for effective and efficient governance of the plan is ensuring that the objectives are widely shared and agreed upon and that the policies and measures are implemented and managed in a coordinated manner, as emerged from the consultation. A similar consensus will be sought as the Plan implementation instruments become operational.
- An evaluation of the actions needed to effectively streamline the procedures for implementing the measures within the timeframes identified. Taken together with the stability of the legislative and regulatory framework, and where compatible with the requirement to periodically update the processes established as a result of technological developments and the monitoring of the costs and benefits of each measure, this will help to ensure that steady progress is made towards achieving the objectives.
- Updating – and, if necessary, revising – the tasks of the various public bodies working on energy and environmental matters to ensure that their roles and activities are coordinated and coherent with the objectives of the plan and, more generally, the objectives of full decarbonisation by 2050.
- Promoting research activities, with the involvement of network operators, on methods for enhancing the integration of the systems (electricity, gas, water), by exploring, for example, the possibility of using pre-existing infrastructure to store renewable energy, including in the long term, with solutions that are effective in terms of economic and environmental costs/benefits.
- Integrating new technologies into the energy system, starting with information technologies, in order to facilitate distributed generation, security, resilience, energy efficiency, and the active participation of consumers in energy markets.
- A willingness to consider additional instruments if necessary, such as, for example, a review of energy taxation, diversified on the basis of polluting and climate-changing emissions, and in any case in line with the Community approach to this issue. In this, consideration would be given to the vulnerable sections of the population and to those production sectors that are still without alternative options to traditional fuel.
- The possibility of using the flexible mechanisms provided for in European sectoral legislation.

With regard to the strategy concerning each of the five dimensions of the Energy Union, remaining faithful to the objectives and measures outlined in the relevant chapters, a number of main elements are provided below.

Dimension decarbonisation

Italy intends to accelerate the transition from traditional fuels to renewable sources, by promoting the gradual phasing out of coal for electricity generation in favour of an electricity mix based on a growing share of renewables and, for the remainder, gas. Making this transition a concrete reality requires and is subject to the planning and construction of replacement plants and the necessary infrastructure.

Italy will implement the policies and measures needed to achieve the objectives of reducing greenhouse gases agreed at European and international level. For those sectors covered by the European Union Emissions Trading System (EU ETS) – primarily the thermoelectric sector and energy-intensive industries – factors contributing to this goal include: the phasing out of coal, scheduled by the end of 2025, as mentioned within the limits of, and as long as the replacement plants and necessary infrastructure are constructed in good time; a higher CO₂ price level than in recent years; and a significant acceleration of renewables and energy efficiency in manufacturing processes. The coal phase-out could be implemented through, among other things, the construction of additional gas-fuelled thermoelectric units, which are necessary in view of the increased proportion of renewables in electricity generation to maintain the system at adequate levels. At present, no gas infrastructure developments are planned, but a temporary increase in gas consumption is envisaged.

For those other sectors included in the objectives established by the Effort Sharing Regulation (ESR), measures that take into account the potential and costs of reducing emissions will be developed; the most important contribution will, in any case, come from the transport and civil (residential and tertiary) sectors, combining measures for using and increasing the efficiency of renewables. For the ESR segments, the involvement of local authorities with direct competence for the transport, residential and services sectors is of fundamental importance.

Italy will promote the further development of renewables while also protecting and enhancing pre-existing products, by exceeding, if possible, the 30% target set, which must, in any event, be assumed to be a contribution towards meeting the EU target. This will be achieved through the use of instruments calibrated on the basis of the sectors of use, types of measures and size of the plants, with an approach aimed at limiting soil consumption and the impact on the landscape and environment, including requirements on air quality. With regard to the electricity sector, and with an additional view to the electrification of consumption, the intention is to make widespread use of built-up areas or areas already in use in some other way, by raising the profile of the different forms of self-consumption, including through distributed generation and storage. A further aim is to promote the creation of systems, starting with a few small islands disconnected from the national networks, in which an accelerated decarbonisation process and electrification of consumption with renewable sources can be trialled. In the heating sector, it will be particularly important to ensure coordination with the instruments for energy efficiency, in particular for buildings, and coherence of the instruments with air quality objectives.

Dimension energy efficiency

The intention is to use a mix of fiscal, economic, regulatory and policy instruments, primarily calibrated by sector of activity and type of target group.

However, attempts will be also be made to integrate the energy efficiency aspect into policies and measures whose main purpose is something other than efficiency, in order to optimise the

cost-benefit ratio of the actions. In this respect, the significant potential for efficiency in the building sector may be better exploited through measures aimed at, for example, the energy renovation of buildings and neighbourhoods, together with the structural renovation, earthquake-proofing, systems upgrading and refurbishment thereof, in line with the strategy for energy renovation of the building stock by 2050. It will thus be possible to give due consideration to the potential contribution to decarbonisation of existing building stock, and of stock not undergoing significant refurbishment, which makes up most of the total built environment. In this context, solar heating, electric and gas heat pumps, and micro and mini high-efficiency cogeneration (HEC) technologies should be carefully considered, especially if fuelled by renewable gas.

With regard to transport, priority is given to policies for reducing demand for mobility and increasing collective mobility, in particular rail transport, which includes shifting freight transport from road to rail. ‘Improve’ measures (regarding vehicle efficiency and emissions) must be supplemented with instruments to reduce mobility needs (‘avoid’ measures) and with efficiency in travel (‘shift’ measures).

As for the remaining demand for private mobility and the mobility of goods, the aim is to promote the use of alternative fuels and, in particular, electricity. This will be done by increasing the share of renewables through economic and regulatory instruments, in coordination with local government bodies.

Along with the ordinary instruments, it will also be possible to use resources from the EU’s development and cohesion programming cycle for 2021-27. In this regard, in the discussions with partners, which involve the Regions, among others, a specific national energy programme has been proposed. Taking the INECP as reference, this is intended to support initiatives to modernise and improve the efficiency of buildings and build new infrastructure, including infrastructure for sustainable mobility. The national programme, when approved, will be coordinated with regionally managed programmes.

Dimension energy security

In terms of security of supply, the aim is, on the one hand, to become less dependent on imports by increasing renewable sources and energy efficiency and, on the other hand, to diversify sources of supply (for example through the use of natural gas, including liquefied natural gas (LNG), with infrastructure consistent with the scenario of deep decarbonisation by 2050).

With regard to the security and flexibility of the electricity system, and notwithstanding the need to promote the extensive involvement of all available resources – including storage, renewables and demand – account must be taken of the transformation of the system resulting from the growing importance of renewables and distributed generation. New operational methods and structures must be tested, including with the active participation of the transmission system operator (TSO). Similarly, the vital need for storage systems must be considered, to prevent overgeneration by electricity plants fuelled by renewables. As evidence of this need, estimates of the power needed from wind and photovoltaic alone to meet the 2030 renewables goals are of the same order of magnitude as the annual peak power demand on the network.

In addition, to achieve the security and flexibility objectives, the intention is to explore the potential offered by growing integration of the electricity and gas network infrastructure. In

this context, it will be important to explore the costs and benefits of power-to-gas technological solutions which, especially over the long term, make it possible to absorb any imbalances between renewable electricity production and energy demand, especially with high levels of photovoltaic penetration. Hydrogen could contribute to this, including for non-electricity consumption.

Particular attention will be paid to the resilience of the systems, in particular of transmission and distribution networks, through preventive measures proportionate to the expected increase in extreme events and periods of heavy load, and operational rules that enable the systems to be quickly restored to normal functioning levels.

In addition, by the end of 2020 the Plan for the Sustainable Energy Transition of Suitable Areas (PSETSA) will be adopted. This document will make it possible to establish a framework of reference of those areas in Italy in which hydrocarbon exploration, research and production activities would be planned, with the aim of improving their environmental, social and economic sustainability. In this respect, the outcomes of the PSETSA analyses could change the national production scenario.

Consumption and sources of supply will be monitored in order to ensure compliance with Security Regulation No 2017/1938 concerning preventive action plans and emergency plans.

Dimension internal market

A greater degree of market integration is considered to be advantageous to the entire Union, and therefore the electricity interconnections and market coupling with other Member States will be enhanced; however, given Italy's geographical position, the interconnections with third countries will also be studied and developed, in order to facilitate efficient trade.

In terms of transmission infrastructure, the references are Terna S.p.A.'s development plans, which will be revised with a view to introducing additional measures, such as centralised storage systems, needed to ensure safe integration of renewable sources, and reducing over-generation, to be implemented in compliance with the provisions of the latest EU guidelines.

In any event, in the long term the electricity market must evolve towards different forms of trading because the cost of renewable sources, on which the focus must necessarily be placed in order to increase their contribution, is predominantly one of investment. Consequently, they make it possible for the producers concerned to present their offering following a different dynamic from gas-fuelled plants, which also have to deal with variable fuel costs. This entails a need to supplement and then adjust market regulation to create a context in which the offerings can be fairly compared and prevent negative effects on system adequacy, which would also have repercussions for the gas market.

The need for flexibility may also prove beneficial to system integration (between electricity, hydro and gas systems in particular), which should be implemented on a trial basis, including with a view to researching the most efficient long-term storage methods for renewable energy. Appropriate changes to the market and to the regulatory system could be analysed to foster the electricity-gas integration of technologies that convert electricity into a gas that can be injected to the network, in line with the provisions for energy storage systems in the recently

approved Electricity Market Directive and Regulation. This would be done taking developments in storage systems, including those enabled by technologies that convert one form of energy to another, and the need to develop seasonal and long-term storage into special consideration.

The expected reduction in the cost of electrolysis technology will make it possible to obtain renewable hydrogen for the decarbonisation of energy-intensive industrial sectors and long-haul commercial transport.

With regard to energy poverty, to supplement the measures described below, studies are under way to introduce efficiency measures and measures for the installation of renewable energy plants with self-consumption.

Dimension research, innovation and competitiveness

There are three fundamental criteria behind research and innovation activities in the energy sector:

- a. the finalisation of resources and activities geared towards the development of processes, products and knowledge that have an outlet into markets opened up as a result of support measures for the use of renewables, energy efficiency and network technology;
- b. synergistic integration between systems and technologies;
- c. viewing 2030 as a milestone in the process towards full decarbonisation, on which Italy is engaged in line with the long-term strategy to 2050, in which ambitious scenarios are proposed that envisage the reduction of emissions eventually to climate neutrality, in line with the EU approach.

Similarly, the support measures for innovation in sectors other than the energy sector will follow an approach, in the light of the Green New Deal, that fosters the modernisation of the production system in line with the medium and long-term energy and environment scenario.

With regard to competitiveness, the strategy outlined in the previous sections must be combined not just with the integration of the single market, but also with careful regulation of the energy markets, so that consumers and businesses can benefit from the positive effects of transparent competition, and prudent use of support mechanisms that may burden the community, as well as integration into the single market.

iii. Overview table with key objectives, policies and measures of the plan

In order to support and provide a solid analytical basis for the INECP, the following scenarios have been drawn up:

- a base scenario that outlines an evolution of the energy system on the basis of current policies and measures;
- an INECP scenario that quantifies the strategic objectives of the plan.

The following tables show the primary objectives of the 2030 plan on renewables, energy efficiency and greenhouse gas emissions, and the main measures established to achieve the targets of the plan.

Table 1 – Primary energy and climate objectives for 2020 and 2030, EU and Italy

	2020 objectives		2030 objectives	
	EU	ITALY	EU	ITALY (INECP)
Renewable energies (RES)				
Share of energy from RES in the gross final consumption of energy	20%	17%	32%	30%
Share of energy from RES in the gross final consumption of energy in the transport sector	10%	10%	14%	22%
Share of energy from RES in the gross final consumption of energy for heating and cooling			+1.3% per year (indicative)	+1.3% per year (indicative)
Energy efficiency				
Reduction in primary energy consumption compared to the PRIMES 2007 scenario	-20%	-24%	-32.5% (indicative)	-43% (indicative)
Final consumption savings as a result of obligatory energy efficiency systems	-1.5% per year (without transport sector)	-1.5% per year (without transport sector)	-0.8% per year (with transport sector)	-0.8% per year (with transport sector)
Greenhouse gas emissions				
Reduction in GHG vs 2005 for all plants subject to ETS rules	-21%		-43%	
Reduction in GHG vs 2005 for all non-ETS sectors	-10%	-13%	-30%	-33%
Overall reduction in greenhouse gases compared to 1990 levels	-20%		-40%	
Electricity interconnectedness				
Level of electricity interconnectedness	10%	8%	15%	10% ¹
Electricity interconnection capacity (MW)		9.285		14.375

¹ The level of electricity interconnectedness to be achieved is deemed to be very ambitious, although it is lower than the overall European objective. This is because of the high / powerful / considerable capacity of non-programmable RES electricity plants, sources that have comparatively lower energy capability than other technologies, which Italy intends to install by the end of 2030. In addition, the country's geographical and morphological features make investment in new electricity interconnections that have to cross mountain chains or be installed under the sea, more onerous than elsewhere.

Table 2– Main measures established to achieve the objectives of the INECP

Scope	Short name for the measure	Type of instrument	Renewable sources	Energy efficiency	Greenhouse gas emissions
Emissions	Environmental Code	Regulatory			GHG ETS: -43%; GHG noETS: -33%
	National code listing good agricultural practices for controlling ammonia emissions	Planning			GHG noETS: -33%
	Progressive traffic ban for more polluting cars	Regulatory			GHG noETS: -33%
	European Union Emissions Trading Scheme (EU ETS)	Regulatory			GHG ETS: -43%;
	Law No 141 of 12 December 2019 converting Decree-Law No 111 of 14 October 2019 (Climate Decree)				GHG noETS: -33%
	Energy Transition Fund for the industry sector				GHG ETS: -43%;
	Improved waste management	Regulatory			GHG noETS: -33%
	Measures to improve air quality in the Po basin	Regulatory			GHG noETS: -33%

	Phase-down of hydrofluorocarbons (HFC)	Regulatory		GHG 33%	noETS: -
	Common agricultural policy (CAP) and rural development plans (RDP) for the period 2014-2020	Economic		GHG 33%	noETS: -
	Common agricultural policy (CAP) and rural development plans (RDP) for the period 2021-2027	Economic		GHG 33%	noETS: -
	Annual report on Italian forests (RAF)	Planning		GHG 33%	noETS: -
	Air quality improvement action plan	Regulatory			
	Reduction of atmospheric pollutants, transposing Directive (EU) 2016/2284	Regulatory			
	Land use, land use change and forestry – LULUCF Regulation	Planning		GHG 33%	noETS: -
	Guidelines on the requirements, procedures and responsibilities for certifying heat generators powered by solid biomass fuel	Regulatory		GHG 33%	noETS: -
Electricity RES	Exemption from self-consumption charges for small plants	Regulatory	RES tot: 30%; RES-E: 55%	GHG 33%	noETS: -

	Promotion of power purchase agreements (PPAs) for large renewable energy plants	Regulatory	RES tot: 30%; RES-E: 55%	GHG ETS: -43%;
	Incentivisation of large renewable energy plants by means of competitive procedures for more mature technologies	Economic	RES tot: 30%; RES-E: 55%	
	Support for large renewable energy plants by means of non-competitive, innovative technologies	Economic	RES tot: 30%; RES-E: 55%	
	Aggregation of small plants to access incentives	Regulatory	RES tot: 30%; RES-E: 55%	
	Consultation with regional authorities to identify suitable areas	Regulatory	RES tot: 30%; RES-E: 55%	
	Streamlining of authorisations and procedures to revamp/repower existing plants	Regulatory	RES tot: 30%; RES-E: 55%	
	Promotion of initiatives to optimise production from existing plants	Information	RES tot: 30%; RES-E: 55%	
	Support for installing distributed storage systems	Economic	RES tot: 30%; RES-E: 55%	
	Streamlining of authorisations for self-consumers and renewable energy communities	Regulatory	RES tot: 30%; RES-E: 55%	
	Review of the rules for granting hydropower concessions	Regulatory	RES tot: 30%; RES-E: 55%	
Electricity RES and thermal RES	Extension and refinement of the obligation to integrate renewables into existing buildings	Regulatory	RES tot: 30%; RES-E:	

			55%; RES-H: 33,9%		
	Refinement of the obligation to integrate renewables into new buildings	Regulatory	RES tot: 30%; RES-E: 55%; RES-H: 33,9%		
	Tax deduction for energy renovations and structural renovations	Fiscal	RES tot: 30%; RES-E: 55%; RES-H: 33,9%	EE prim. cons. - 43%; EE fin. cons. - 0,8%/y	GHG noETS: - 33%
	Incentives for promoting electric and thermal renewables on smaller islands	Economic	RES tot: 30%; RES-E: 55%; RES-H: 33,9%		

Thermal RES efficiency	White certificates	Economic	RES tot: 30%; RES-H: 33,9%	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG ETS: - 43%; GHG noETS: -33%
	Thermal energy account	Economic	RES tot: 30%; RES-H: 33,9%	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Grants to municipalities for energy efficiency and sustainable local development investments	Economic	RES tot: 30%; RES-H: 33,9%	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
RES in the transport sector	Incentives for biomethane and other advanced biofuels	Economic	RES tot: 30%; RES-T: 22%		GHG noETS: -33%
	Obligation on biofuels and other RES, transposing RED II	Regulatory	RES tot: 30%; RES-T: 22%		GHG noETS: -33%
	6% reduction in GHG emissions from fuels by 2020	Regulatory	RES tot: 30%; RES-T: 22%		GHG noETS: -33%
	Sustainability certification of biofuels	Regulatory	RES tot: 30%; RES-T: 22%		GHG noETS: -33%

Efficiency in the transport sector	National Plan for Electric Vehicle Charging Infrastructure (PNIRE)	Planning	RES tot: 30%; RES-T: 22%	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Upgrading of infrastructure (regional rail transport)	Planning		EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Upgrading of infrastructure (rapid mass transport systems)	Economic		EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Urban Plans for Sustainable Mobility (PUMS)	Planning		EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Renewal of public passenger transport vehicles (renewal of the fleet of local public transport vehicles)	Economic		EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Renewal of public passenger transport vehicles (renewal of trains)	Economic		EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Renewal of public passenger transport vehicles (obligation to acquire vehicles using alternative fuels for public service)	Regulatory		EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Renewal of private passenger transport vehicles (regulatory measures)	Regulatory		EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%

	Renewal of private passenger transport vehicles (Directive on the deployment of alternative fuels infrastructure – DAFI)	Planning	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Renewal of private passenger transport vehicles (incentives to acquire more efficient vehicles with lower climate-changing emissions)	Economic	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Modal shift in the context of passenger transport (measures for mobility management)	Planning	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Modal shift in the context of freight transport	Planning	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Modal shift in the context of freight transport (Marebonus incentive)	Economic	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Modal shift in the context of freight transport (Ferrobonus incentive)	Economic	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Renewal of freight transport vehicles	Planning	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Efficiency in non-transport sectors	Energy audits on businesses	Regulatory	EE prim. cons. -43%; EE fin. cons. -0,8%/y

	National energy efficiency fund	Economic	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Obligation to increase the efficiency of public lighting infrastructure	Regulatory	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	National Plan for Business 4.0	Fiscal	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Strengthening of measures aimed at changing consumer behaviour	Planning	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Consumer information and training programmes (PIF)	Training information	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Tax deduction for energy renovations and structural renovations	Fiscal	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
	Energy Renovation Programme for the Central Public Administration (PREPAC)	Economic	EE prim. cons. -43%; EE fin. cons. -0,8%/y	GHG noETS: -33%
Electricity security	Adaptation of the guidelines concerning authorisations for thermoelectric plants	Planning		
	Updating of the Emergency Security Plan for the Electricity System (PESSE)	Regulatory		

	Cybersecurity	Planning
	Capacity market	Regulatory
	Defence plans for the transmission network and adoption of measures for continuous technological adaptation	Planning
	Plans for network resilience in the event of extreme weather events	Planning
Gas security	Updating of the emergency plan for the Italian natural gas system, in coordination with the emergency plans developed by other countries along the same supply corridors under Regulation (EU) 2017/1938.	Regulatory
	Coordination of the 10-year plans to develop the Italian national network of gas pipelines with the plans of other European TSOs and studies on the possible use of gas infrastructure for hydrogen	Planning
	Cybersecurity	Planning
	Diversification of sources of supply, including by means of LNG	Planning
	Revision of the preventive action plan for the Italian natural gas system according to the new Security Regulation No 2017/1938	Regulatory

	Organisation of solidarity measures between Member States	Planning	
Electricity market	Adaptation of the measure in favour of energy-intensive businesses	Regulatory	
	Updating of the dispatching model and the role of Distribution System Operators (DSOs)	Regulatory	
	Completion of the liberalisation of retail markets	Regulatory	
	Deployment of technology for integrating vehicles with the electricity grid: vehicle-to-grid	Planning	
	Upgrading of concentrated storage systems	Planning	
	Reorganisation and streamlining of self-consumption configurations	Planning	RES tot: 30%; RES-E: 55%
	Excess Single National Price (PUN) for electricity	Planning	
	Development of continuous trading on the intraday market	Regulatory	
	Development of market coupling	Planning	
	Development of energy communities	Planning	RES tot: 30%; RES-E: 55%
	Development of distributed storage systems	Planning	

	Development of storage systems coherent with the safe and effective management of the national transmission network (RTN)	Planning	
	Upgrading of electricity interconnections with foreign countries	Planning	
	Development of the internal network	Planning	
	Aggregation of generating plants, including in association with storage systems, and consumption units in order to access the services markets	Regulatory	RES tot: 30%; RES-E: 55%
Electricity and gas market	Enhancement of the electricity and gas bonus and the bonus for automation systems in order to access the measure	Regulatory	
Gas market	Introduction of Sulphur Emission Control Areas (SECAs) to Italian seas, in coordination with cross-border countries	Regulatory	
	Reduction of the spread between gas prices at the virtual trading point (VTP) and North-European price hubs	Planning	
	Tax stabilisation for LNG in the transport sector	Fiscal	
	Liberalisation of retail markets	Regulatory	
	Development of the use of biomethane in non-transport sectors (establishment of single	Planning	

	points of contact, streamlining measures)	
	Development of LNG in the maritime transport and heavy goods vehicle sector	Planning
Research, innovation and competitiveness	Innovation agreements	Research
	Energy clusters	Research
	Guarantee fund	Economic
	Research fund for the electricity system	Regulatory
	Increase in public research funds for the Mission Innovation initiative	Economic
	Hyper- and super-depreciation	Fiscal
	Research tax credit	Fiscal
	Cooperation agreement for biofuels in aviation	Planning
	ENAC research project for producing alternative fuel	Research
	Incentive for capital goods (the 'Nuova Sabatini' incentive)	Economic
Innovation Fund	Economic	

1.2 Overview of current policy situation

i. National and Union energy system and policy context of the national plan

With the signing of the **Kyoto Protocol**, the European Union and its Member States committed themselves to a path aimed at combating climate change through the adoption of EU and national policies and measures for the decarbonisation of the economy.

This path was confirmed during the 21st Conference of the Parties to the Framework Convention on Climate Change, held in Paris in 2015, through the adoption of the **Paris Agreement** by Decision 1/CP21. The Agreement establishes the need to hold the increase in the global average temperature to well below 2 °C and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels.

Italy signed the Agreement on 22 April 2016 and ratified it on 11 November 2016. At the time of writing, the Agreement, which entered into force on 4 November 2016, had been ratified by 184 of the 197 parties to the framework convention.

With the European Council of March 2007, provision was made for the first time at EU level for an integrated approach between energy policies and the fight against climate change, with the **2020 Climate and Energy Package**.

The targets of the package, some of which are binding, have been transposed into the national legislation of the Member States as of 2009. For Italy, those binding targets include a target to reduce greenhouse gas emissions in those sectors not regulated by the ETS Directive by 13% by 2020, compared with 2005 levels. With regard to the promotion of renewable energy sources, Italy has been set the target of achieving a 17% share of energy from renewables in the gross final consumption of energy by 2020 and a sub-target of a 10% share of energy from renewables in the gross final consumption of energy in the transport sector.

The overall gross final consumption of energy (namely the measurement introduced by Directive 2009/28/EC for the purposes of monitoring EU targets for RES) in Italy in 2017 totalled around 120 Mtoe, with energy from RES totalling around 22 Mtoe: the share of consumption covered by RES was therefore 18.3%, higher than the 2020 target set for Italy by Directive 2009/28/EC.

With regard to the electricity sector, in 2017, approximately 35% of gross national production originated from RES; the renewable source that made the greatest contribution to actual electricity production in 2017 was hydropower (35% of overall electricity production from RES), followed by solar power (23%), bioenergy (19%), wind power (17%) and geothermal power (6%).

In the heating sector, less than 20% of overall energy consumption originated from renewable sources. In particular, approximately 11.2 Mtoe of energy from RES was consumed in 2017, approximately 10.3 Mtoe of which was consumed directly (through individual boilers, stoves, chimneys, solar panels, heat pumps, plants for using geothermal heat) and approximately 0.9 Mtoe in the form of derived heat consumption (for example through biomass-fired district heating systems). The renewable source that was most used in 2017 for heat consumption was solid biomass (approximately 7.9 Mtoe), which was

primarily used in the household sector in the form of firewood and pellets. Heat pumps also play an important role (2.65 Mtoe), whereas the contributions from bioliquids, biogas, geothermal power and solar power are still limited.

With regard to the transport sector, approximately 1.2 million tonnes of biofuels were released for consumption in 2017 (energy content equal to 1.06 Mtoe), which largely consisted of biodiesel.

Italy's good degree of energy efficiency has been demonstrated: in 2016, the ODEX index for the whole Italian economy, 92.7, confirmed the improvements made since 2005 (index value of 100 for the reference year 2000).

In 2016, the final consumption of energy (excluding non-energy uses) totalled 115.9 Mtoe (source: Eurostat energy balances), a slight reduction compared with 2015 (-0.3%). The downward trend shown over the last few years in the transport sector continued, settling at a consumption of 39.1 Mtoe (-1.1%); consumption in the residential sector was equal to 32.2 Mtoe (-1.0% compared with 2015). Going against the trend, however, the services and industrial sectors registered +0.3% and +1.4% increases in consumption, respectively, which were primarily caused by trends in economic activity.

In 2016, Italy's primary energy intensity was 107.8 toe/million€2005; the decrease compared with 2015 (-1.8%) was caused by a reduction in primary consumption in the face of GDP growth; generally speaking, the reduction in energy intensity recorded by Italy in 2016 was amongst the largest in the European Union.

Over the last few years, the steadily growing impact of RES and the reduction in energy intensity have helped Italy become less dependent on foreign sources of supply; the share of national energy demand met by net foreign imports remains high (at 77.7%), but is approximately five percentage points lower than in 2010.

After a decade of almost continuous decline, primary energy demand started to increase once again in 2017 (+1.5% compared with 2016); this demand is met less and less by oil (which nevertheless still represents one third of the total), solid fuels (6.1%) and imported electricity (4.9%). The contribution of gas, however, is increasing (36.2%), as is the contribution from renewable sources (a little under one fifth).

Italy's path towards sustainability beyond 2020 will follow in the tracks of the **Energy Union strategy** – based on five dimensions: decarbonisation (including renewables), energy efficiency, energy security, a fully integrated energy market, research, innovation and competitiveness – and the new **2030 Framework for Climate and Energy** approved by the European Council in its conclusions of 23 and 24 October 2014, and subsequent implementing provisions.

In light of this situation, and with a view to 2030 and the Roadmap 2050, Italy is making efforts towards creating planning instruments to identify objectives, policies and measures coherent with the European framework and compatible with the aim of improving environmental sustainability, security and the affordability of energy.

The Decree of the Minister of Economic Development and the Minister of the Environment and Land and Sea Protection of 10 November 2017 approved the new **National Energy Strategy** (SEN), which, as was stated by the ministers that approved it, was not so much a

destination as a starting point for drafting the INECP, used for the basic technical examination and the consultation performed.

In addition to the National Energy Strategy, there are various important documents that outline a national context favourable to the adoption of the INECP, some of which are cited below.

In 2013, the adoption of the **‘European strategy on adaptation to climate change’** was the catalyst for European countries to develop a national strategy in this respect. By way of the Decree of the Ministry of the Environment of 16 June 2015, the **National strategy on adaptation to climate change** was approved, with the objective of defining how to tackle the impacts of climate change, including climatic variations and extreme weather and climate events, and identifying a set of actions and guidelines aimed at reducing to a minimum the risks of climate change, protecting the health, wellbeing and property of the population, preserving natural heritage, and maintaining or improving the ability of natural, social and economic systems to adapt.

On 7 December 2017, the document **‘Towards a circular economy model in Italy – Framework and strategic positioning document’**, drafted by the Ministry of Economic Development and the Ministry of the Environment and Protection of Natural Resources and the Sea was approved. The aim of the document is to provide a general framework for a circular economy and to define Italy’s strategic position in this respect, in keeping with the commitments undertaken within the context of the Paris Agreement on climate change, the United Nation’s 2030 Agenda for Sustainable Development and during the G7 summit: all of this in order to define a framework for moving from the current linear economy model to a circular one, with market strategies and models being reconsidered, and also for the purpose of safeguarding the competitiveness of industrial sectors and protecting natural resources.

The **National Strategy for Sustainable Development (SNSvS)**, approved by the Interministerial Committee for Economic Planning (CIPE) on 22 December 2017, lays out a vision for the future and for development focused on sustainability, as a shared value essential to tackling the global challenges facing Italy. The Strategy represents the first step towards transposing the principles and objectives of the 2030 Agenda for Sustainable Development at a national level, by assuming its four guiding principles: integration, universality, transformation and inclusion. The SNSvS is split into five areas, corresponding to what are known as the ‘5Ps’ of sustainable development proposed by the 2030 Agenda: People, Planet, Prosperity, Peace and Partnership. A sixth area is dedicated to what are known as vectors for sustainability, to be regarded as essential elements for achieving the strategic national objectives. The document briefly puts forward a vision for a new circular economy model, with low CO₂ emissions and resilience to climate change and other global changes caused by local crises, such as, for example, the loss of biodiversity, altered fundamental biogeochemical cycles (carbon, nitrogen, phosphorus) and changes to land use.

The document **‘Elements for a roadmap to sustainable mobility’**, drafted in 2017 in collaboration with the Ministry of the Environment and Protection of Natural Resources and the Sea, the Ministry of Economic Development, the Ministry of Infrastructure and Transport, research organisations, economic operators in the sector and consumer and trade associations, outlines the current mobility situation in Italy and its environmental impacts, and provides an in-depth look into the opportunities offered by the technological development of transportation means. According to this document, the creation in Italy of an industrial chain of vehicles based on innovative technologies represents an indispensable component for developing a vast infrastructure for alternative fuels. The roadmap also

highlights the role of support measures, with great importance being placed on local policies in favour of sustainable mobility. In fact, the critical issues of traffic congestion, polluting emissions and road safety are concentrated in cities. A cultural change towards modal shift and the use of bicycles, public transport, shared and electric mobility and vehicles that use alternative fuels thus needs to be triggered in cities. The increasingly widespread use of digital applications, such as, for example, web conferences, teleworking and smart working is also desirable, as is the creation of online services to reduce the need for people to travel.

The **National Plan for Electric Vehicle Charging Infrastructure (PNIRE)**, approved in 2012 and updated in 2016, was adopted through a joint process involving the main competent departments and stakeholders in the sector. The targets of the Plan to be achieved by 2020 are to create up to 13,000 slow/accelerated charging stations and 6,000 fast charging stations, at a ratio of one public charging station to every eight private charging stations, and to have 130,000 electric vehicles in circulation. Within this context, a programme agreement was signed in 2017 between the Regions and local authorities for the creation of electric vehicle charging networks, which aimed to focus the measures for implementing the Plan on actual regional needs, by promoting and enhancing participation by public and private entities. Provision is made for a total budget of €72.2 million, in respect of government co-financing totalling €28.7 million.

The PNIRE is currently being updated from an integrated perspective that also considers other measures to support demand for electric vehicles, and to upgrade and facilitate the use of infrastructure. The possibility of coordinating the development of recharging infrastructure with plans to rationalise the fuel network is also being assessed.

The **Action plan for environmental sustainability of consumption in the public administration sector**, also known as the National Action Plan on Green Public Procurement (PAN GPP) establishes the following three main strategic environmental objectives: reduction in greenhouse gas emissions, reduction in hazardous chemicals, and recycling and reuse of materials.

The **Action plan on sustainable production and consumption (PAN SCP)** forms part of international and national policies and strategies on the circular economy, the efficient use of resources and climate protection, implementing EU guidelines on the European Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan COM(2008)397 and the United Nation's 2030 Agenda.

The **National strategic framework for the development of the alternative fuels market in the transport sector and the creation of associated infrastructure** (Legislative Decree No 257 of 16 December 2016) promotes the use of alternative fuels, in particular electricity, natural gas and hydrogen. With regard to electricity, the Decree has established measures to create an appropriate number of charging stations. In particular, it introduces the obligation to put in place conditions for the installation of electrical charging infrastructure in new structures. Consequently, local building regulations must be adapted to the new provisions. A compulsory requirement is also envisaged for local authorities to ensure that, at the time of their renewal, their fleet of cars, buses and public service vehicles is made up of at least 25% electric vehicles or vehicles fuelled with LNG or CNG. The regulation also provides for the establishment of LNG refuelling stations in ports for inland waterway and maritime navigation. A pathway towards the possible use of hydrogen in the transport sector has also been established.

In 2019, the new President of the European Commission posed ambitious short-term challenges for the. She noted that a distinguishing feature of her mandate would be a 'European Green New Deal', i.e. a rethinking of the current economic paradigms and behavioural models to achieve a sustainable Europe for future generations that aims to become the world leader in the circular economy and clean technologies.

The Italian Government shares this approach and has launched its own '**Green New Deal**': a green covenant with businesses and citizens that views the environment as the economic driver of the country, steering the national production system towards sustainability.

Following on from the aims of the Green New Deal, the **note updating the Economy and Finance Document for 2019** (naDEF2019) envisages incentives and support measures that will pursue the goal of protecting the environment and fostering growth and the circular economy. First, two new investment funds, assigned to the State and to regional and local authorities, will be introduced in the Budget Law for 2020. The resources will be allocated to new urban regeneration and energy conversion projects and to incentives for the use of renewables. For 2019-21 incentives for building improvements are envisaged, to be implemented through the application of reduced rates of registration, mortgage and land registry taxes on transfers of buildings, for construction or renovation companies engaging in energy upgrade projects and subsequently transferring them to other owners. To boost investment by local authorities, with effect from 2020 a fund assigned to municipalities for initiatives involving energy efficiency, sustainable local development and the security of infrastructure and public buildings will be in place.

Another aim of note naDEF2019 is to accelerate investment in the rail network, as included in the update of the Italian Railway Network Programme Contract for 2017-2021. Here, the aim is to develop an integrated intermodal programme that would establish the railway system as a link between ports and airports. Rail transport would be given a more central role by increasing the efficiency of the existing stock and by doubling and electrifying the local public transport (LPT) offering. Work will also be taken forward on the electrification of Italy's ports. The Government is well aware of the impact of LPT systems on citizens' quality of life and on urban environments and intends to support strategic local and urban mobility through appropriate investment on mass rapid transport and the renewal of the bus fleet. Economic resources will be earmarked to contribute to the replacement of public transport vehicles with the aim of incentivising transport security and safety and reducing CO₂ emissions.

The Budget Law for 2020 followed up on the provisions of note naDEF2019; the measures adopted are described in the relevant parts of the Plan. However, it is worth noting in this section the creation of 'green' government securities. Issuances of Green Bonds will be proportionate to interventions funded from the State budget to combat climate change, promote energy conversion and the circular economy, protect the environment and foster social and territorial cohesion.

Law No 141 of 12 December 2019, converting Decree-Law No 11 of 14 October 2019, introduces measures to improve air quality, in coordination with the INECP, and paves the way for policies to incentivise environmentally sustainable behaviours (measures to incentivise sustainable mobility in metropolitan areas, provisions to promote sustainable school transport, etc.).

The draft **European Delegation Law 2019**, which gives the Italian Government delegated powers to adopt legislative decrees to implement European Directives on a range of issues, including renewables and the internal market, is currently being submitted to Parliament. The

bill sets out a number of specific guiding principles and criteria to be taken forward. As regards renewables, the selection of the criteria on the basis of which each Region and Autonomous Province identifies which areas are and are not suitable for the installation of plant powered by renewable sources is worthy of note. Another point worth noting is the identification of processes to ensure that the deadlines for completion of the relevant procedures, including environmental ones, are met. A reorganisation and strengthening of the legislative provisions governing systems to foster self-consumption and at the same time monitor any effects it might have in terms of the setting and collection of system charges, is also envisaged. A further aim is to promote the spread and use of energy storage systems, including electric vehicles and long-term storage, and the integration of the electricity system with gas and hydro systems. It is also deemed important to update and strengthen support mechanisms for electricity and thermal renewable sources, and renewables for transport, including by fostering the replacement of obsolete plant, with a view to safeguarding, enhancing and increasing generation from the existing stock of plant using renewables, including hydroelectric plant.

As regards the markets, the draft European Delegation Law for 2019 aims to promote the active role of consumers, in both direct and aggregate form, in electricity and services markets, not least with the aim of improving the flexibility of the electricity system by managing demand. Another goal is to establish a regulatory framework for the development of citizens' energy communities that would be active in the generation, supply, distribution, storage, sharing and sale of electricity and the supply of energy services, including energy efficiency and electric vehicle recharging services.

Yet another aim is to establish a framework of rules for the development and propagation of storage systems and for their participation in the electricity and services markets. This would follow criteria of technological neutrality and take into account the objectives of integrating generation from renewables and the conditions for operating the networks safely and securely. On the energy poverty front, the aim is to strengthen the measures for the protection of vulnerable customers, including through automatic procedures to deliver the benefits in question, and to establish specific monitoring indicators.

In addition to this Plan, Italy is required to submit its Long-Term Strategy to the European Commission, in implementation of Article 15 of the EU Governance Regulation. To quantify the effort required, the Strategy identifies possible pathways to achieve 'climate neutrality' by 2050, in line with EU and Italian policy approaches. It also sketches out, as a first step, a reference scenario characterised by three essential elements:

- i) meet the goals envisaged by the INECP, carrying forward the resulting virtuous energy-environmental trends until 2050;
- ii) employ 'exogenous' GDP and population trends in line with the latest ISTAT projections, which should be integrated in the next round of European simulations;
- iii) integrate the effects of climate change, in terms of potential changes in day degrees, crop yields and the frequency of fires. The use of up-to-date GDP and population projections (point ii) above) entails a difference with respect to the parameters for these values used in the INECP context. For this, the EU reference scenario values for 2016 were used, including at the invitation of the Commission. The analyses conducted point to limited differences up to 2030, which do not have a significant impact in terms of meeting the INECP targets and developing infrastructure. As a result of the European simulations, the first update of the INECP, to be submitted to the Commission by 30 June 2023 under Article 14 of the Governance Regulation, will be an opportunity to bring the two instruments more fully into line.

ii. Current energy and climate policies and measures relating to the five dimensions of the Energy Union

In the past, Italy has devoted a great deal of attention to the five dimensions of the Energy Union and continues to do so today, having implemented numerous measures for sustainable energy development and the fight against climate change.

The following table shows the main measures in force concerning the five dimensions of the Energy Union.

Table 3 – Main current policies and measures for energy and climate concerning the five dimensions of the Energy Union (for the sake of simplicity, the table shows one main aspect for each policy, but many of the measures cover more than one aspect, for example the efficiency measures also cover decarbonisation)

DIMENSION	SECTOR	MEASURE
DECARBONISATION – Greenhouse gas emissions and removals	Industry	European Union Emissions Trading Scheme (EU ETS)
DECARBONISATION – Greenhouse gas emissions and removals	Transport sector	Progressive traffic ban for more polluting cars (Legislative Decree No 50/2017, and previous)
DECARBONISATION – Greenhouse gas emissions and removals	Non-energy sector	Full transposition of the EU regulation on fluorinated greenhouse gases (Regulation (EU) No 517/2014)
DECARBONISATION – Greenhouse gas emissions and removals	Non-energy sector	Improved waste management in landfills (Ministerial Decree of 25 June 2015, and previous)
DECARBONISATION – Greenhouse gas emissions and removals	Non-energy sector	EU Common Agricultural Policy (CAP) and Rural Development Plans (RDP) for the period 2014-2020
DECARBONISATION – Greenhouse gas emissions and removals	Non-energy sector	Reduction in atmospheric emissions from agricultural and farming activities (Po Basin Agreement 2013)
DECARBONISATION – Greenhouse gas emissions and removals	Non-energy sector	Environmental Code
DECARBONISATION – Renewables	Electricity sector	Green certificates (Ministerial Decree of 18 December 2008, and previous)
DECARBONISATION – Renewables	Electricity sector	All-inclusive tariff (Ministerial Decree of 16 December 2008)

DECARBONISATION Renewables	–	Electricity sector	Incentivisation of non-photovoltaic electric renewables (Ministerial Decree of 6 July 2012)
DECARBONISATION Renewables	–	Electricity sector	Incentivisation of non-photovoltaic electric renewables (Ministerial Decree of 23 June 2016)
DECARBONISATION Renewables	–	Electricity sector	Exemption from self-consumption charges
DECARBONISATION Renewables	–	Electricity sector	Guidelines on ex ante evaluation of water sources (Decree No 29/STA of 13 February 2017)
DECARBONISATION Renewables	–	Electricity sector	Guidelines on updating methods for determining minimum vital water flow (Decree No 29/STA of 13 February 2017)
DECARBONISATION Renewables	–	Electricity sector	Tax deductions for structural renovations (Law No 449 of 27 December 1997, and subsequent amendments and additions)
DECARBONISATION Renewables	–	Electricity sector	Dispatching priority (Legislative Decree No 79 of 16 March 1999, and subsequent)
DECARBONISATION Renewables	–	Electricity sector	Net metering (Resolution No 570/2012 of the Regulatory Authority Energy, Networks and the Environment (ARERA) and subsequent amendments and additions)
DECARBONISATION Renewables	–	Electricity sector	Super-depreciation (Law of 27 December 2017, and previous)
DECARBONISATION Renewables	–	Electricity sector, heating sector	Obligation to integrate renewables into new or renovated buildings (Legislative Decree No 28/2011 – Annex 3)
DECARBONISATION Renewables	–	Electricity sector, heating sector	Renewable sources on smaller islands (Ministerial Decree of 14 February 2017)

DECARBONISATION Renewables	–	Heating sector	Thermal energy account (Ministerial Decree of 16 February 2016, and previous)
DECARBONISATION Renewables	–	Heating sector	Tax deductions for energy renovation (Law No 205 of 27 December 2017, and previous)
DECARBONISATION Renewables	–	Transport sector	Biofuels (Ministerial Decree of 10 October 2014, and subsequent amendments and additions)
DECARBONISATION Renewables	–	Transport sector	Biomethane incentives (Ministerial Decree of 2 March 2018, and previous)
ENERGY EFFICIENCY		Industry	Energy audits and management systems (Legislative Decree No 102/2014)
ENERGY EFFICIENCY		Industry	‘Nuova Sabatini’ incentive (Article 2 of Decree-Law No 69/2013)
ENERGY EFFICIENCY		Industry	National ‘Industry 4.0’ Plan (Law No 205 of 27 December 2017, and previous)
ENERGY EFFICIENCY		Industry, residential, tertiary, transport sector	White certificates (Ministerial Decree of 10 May 2018, and previous)
ENERGY EFFICIENCY		Industry, residential, tertiary, transport sector	National Energy Efficiency Action Plan 2017 (PAEE) Results achieved as of 2016 and main measures to achieve the 2020 energy efficiency objectives (Ministerial Decree of 11 December 2017)
ENERGY EFFICIENCY		Industry, tertiary sector	High-efficiency cogeneration (Ministerial Decree of 5 September 2011)
ENERGY EFFICIENCY		Industry, public administration	National energy efficiency fund (Ministerial Decree of 22 December 2017)
ENERGY EFFICIENCY		Public administration	Energy efficiency ‘control room’ (Ministerial Decree of 9 January 2015)

ENERGY EFFICIENCY	Public administration	Thermal energy account (Ministerial Decree of 16 February 2016, and previous)
ENERGY EFFICIENCY	Public administration	Minimum environmental criteria (Ministerial Decree of 11 January 2017)
ENERGY EFFICIENCY	Public administration	Kyoto Fund (Ministerial Decree of 14 April 2015)
ENERGY EFFICIENCY	Public administration	2014-2020 Development and Cohesion Fund (Legislative Decree No 88/2011)
ENERGY EFFICIENCY	Public administration	PREPAC programme (Ministerial Decree of 16 September 2016)
ENERGY EFFICIENCY	Public administration	Reprogramming of the Kyoto Fund for public school buildings (Ministerial Decree of 22 February 2016)
ENERGY EFFICIENCY	Public administration	Integrated energy service – Consip
ENERGY EFFICIENCY	Public administration	Electricity service – Consip
ENERGY EFFICIENCY	Residential	Tax deduction for energy renovation (Law No 205 of 27 December 2017, and previous)
ENERGY EFFICIENCY	Residential	Tax deduction for structural renovations (Law No 449 of 27/12/1997)
ENERGY EFFICIENCY	Residential	New guidelines on energy performance contracts for buildings (Legislative Decree No 50/2016)
ENERGY EFFICIENCY	Residential	Real estate taxation, support for housing policies and local finance (Law No 124 of 28 October 2013, the 'Plafond casa' initiative)

ENERGY EFFICIENCY	Residential, tertiary	Energy performance of buildings (EPBD) (Directive 2018/844, and previous)
ENERGY EFFICIENCY	Residential, tertiary	National action plan to increase the number of nearly zero-energy buildings (PANZEB) (Ministerial Decree of 19 June 2017)
ENERGY EFFICIENCY	Residential, tertiary	Consumer information and training programmes (Article 13 of Legislative Decree No 102/2014)
ENERGY EFFICIENCY	Residential, tertiary	Minimum requirements for energy performance in buildings (Ministerial Decree of 26 June 2015)
ENERGY EFFICIENCY	Transport sector	Environmental connection (Law No 208 of 28 December 2015)
ENERGY EFFICIENCY	Transport sector	Financing for renewing the local public road transport fleet (Law No 232 of 11 December 2016)
ENERGY EFFICIENCY	Transport sector	Incentives for the development of intelligent transport systems (ITS) (traffic management, infomobility, smart roads) (Ministerial Decree of 28 February 2018)
ENERGY EFFICIENCY	Transport sector	Modal integration, enhancement of last-mile rail and road infrastructure (ports and dry ports) (2017 Economic and Financial Document (DEF), Annex: Infrastructure)
ENERGY EFFICIENCY	Transport sector	National Plan for Electric Vehicle Charging Infrastructure (PNIRE) (Law No 134 of 7 August 2012)
ENERGY EFFICIENCY	Transport sector	Charging stations for electric vehicles (Legislative Decree No 257/2016, transposing the DAFI Directive)
ENERGY EFFICIENCY	Transport sector	TEN-T network (rail freight corridors), 2030 core network, 2050 comprehensive network (2016 DEF, Annex: Infrastructure)

ENERGY EFFICIENCY	Transport sector	Electric vehicle conversion systems for cars, buses and lorries (Ministerial Decree of 1 December 2015)
ENERGY EFFICIENCY	Transport sector	SNIT 1 and SNIT 2 – Development of transport and logistical infrastructure (2015, 2016, 2017, 2018 DEF, Annex: Infrastructure)
ENERGY EFFICIENCY	Transport sector	Development and promotion of pedestrian/cyclist mobility (Law No 2 of 11 January 2018)
ENERGY EFFICIENCY	Transport sector	Development of sharing mobility (carpooling, car sharing, van sharing) (2016 DEF, Annex: Infrastructure)
ENERGY EFFICIENCY	Transport	Development of rapid mass transport (Law No 205 of 27 December 2017)
ENERGY SECURITY	Electricity sector	Emergency Security Plan for the Electricity System (PESSE) (regular updates, CIPE Decision of 6 November 1979)
ENERGY SECURITY	Gas sector	Updating of the preventive action plan for the Italian natural gas system (Ministerial Decree of 18 October 2017, Annex I)
ENERGY SECURITY	Gas sector	Updating of the emergency plan for the Italian natural gas system (Ministerial Decree of 18 October 2017, Annex II)
ENERGY SECURITY	Gas sector	Adaptation of the gas transport network and modernisation of monitoring systems
ENERGY SECURITY	Gas sector	Adoption of measures to tackle unfavourable situations for the gas system by means of the in-put of gas specifically stored in LNG terminals into the network (Ministerial Decree of 18 October 2013 – Provisions for implementing peak shaving)

ENERGY SECURITY		Gas sector	Determination of the volumes of gas earmarked for strategic storage
ENERGY SECURITY		Gas sector	Determination of the distribution profiles from underground storage facilities for natural gas, on the basis of the needs of protected customers
ENERGY SECURITY		Gas sector	Interconnections with Malta, Albania and Greece. Evaluation of possible recovery of the loss of capacity of imports from northern Europe
INTERNAL MARKET	ENERGY	Electricity inter-connections	Development of interconnection capacities with foreign countries
INTERNAL MARKET	ENERGY	Electricity network	Creation of energy storage systems (Legislative Decree No 28/2011 and Legislative Decree No 93/2011)
INTERNAL MARKET	ENERGY	Electricity network	Authorisation of connections to electricity networks (Articles 4 and 16 of Legislative Decree No 28/2011)
INTERNAL MARKET	ENERGY	Electricity network	Development planning for the national transmission network (Article 17 of Legislative Decree No 28/2011)
INTERNAL MARKET	ENERGY	Electricity network	Remuneration of measures carried out on the national transmission network (Article 17 of Legislative Decree No 28/2011)
INTERNAL MARKET	ENERGY	Electricity network	Remuneration of measures carried out on the national transmission network – smart grids (Article 18 of Legislative Decree No 28/2011)
INTERNAL MARKET	ENERGY	Electricity network	Streamlining of procedures for connecting photovoltaic installations on buildings (Ministerial Decree of 19 May 2015)

INTERNAL MARKET	ENERGY	Gas network	Transition of the allocation of regasification capacity regulated on the basis of tariff mechanisms to auction mechanisms
INTERNAL MARKET	ENERGY	Gas network	Modernisation of the national gas network and adaptation of odorising systems
INTERNAL MARKET	ENERGY	Electricity market	Reduction in tariff charges for electricity consumption (Article 19(1) of Law No 167 of 20 November 2017)
INTERNAL MARKET	ENERGY	Electricity market	Decree on energy-intensive users (Ministerial Decree of 21 December 2017)
INTERNAL MARKET	ENERGY	Electricity and gas market	Active consumer roles
INTERNAL MARKET	ENERGY	Dispatching	Aggregation of generating plants and users (Legislative Decree No 102/2014)
INTERNAL MARKET	ENERGY	Dispatching	Participation in distributed generation and dispatching market demand on the part of aggregators
INTERNAL MARKET	ENERGY	Electricity market	Social bonus for electricity (Ministerial Decree of 28 December 2007 and ARERA resolutions)
INTERNAL MARKET	ENERGY	Gas market	Social bonus for gas (Ministerial Decree of 28 December 2007 and ARERA resolutions)
RESEARCH, INNOVATION AND COMPETITIVENESS		Research	Cooperation agreements
RESEARCH, INNOVATION AND COMPETITIVENESS		Research	Research financing for the energy system and clean technologies (Mission Innovation)
RESEARCH, INNOVATION AND COMPETITIVENESS		Research	Public/private research partnerships (Legislative Decree No 56 of 19 April 2017)

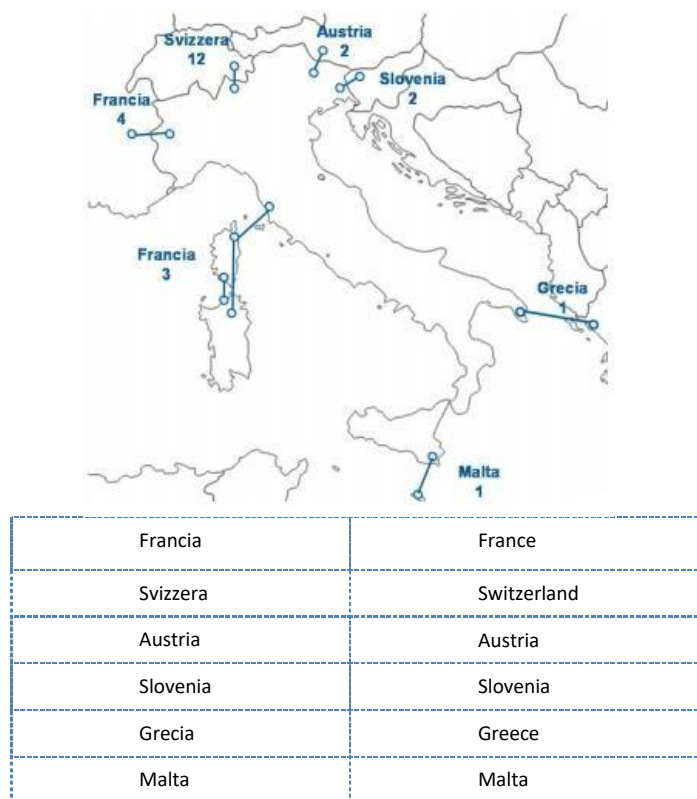
RESEARCH, INNOVATION AND COMPETITIVENESS	Research	Research projects
RESEARCH, INNOVATION AND COMPETITIVENESS	Competitiveness	ACE – Aid for economic growth (Decree-Law No 201 of 6 December 2011, and subsequent amendments and additions)
RESEARCH, INNOVATION AND COMPETITIVENESS	Competitiveness	Companies income tax (IRES), corporation tax (IRI) and cash accounting (Law No 232 of 11 December 2016)
RESEARCH, INNOVATION AND COMPETITIVENESS	Competitiveness	Incentives for energy-intensive businesses (Ministerial Decree of 21 December 2017)
RESEARCH, INNOVATION AND COMPETITIVENESS	Competitiveness	Productivity pay (Law No 232 of 11 December 2016)

iii. Key issues of cross-border relevance

In 2017, 88.2% of electricity demand was met by domestic production (the same figure as in 2016), totalling 282.8 billion kWh (+2.0% compared with 2016) net of consumption for ancillary services and pumping. The remaining share of demand (11.8%) was covered by net foreign imports, totalling 37.8 billion kWh – an increase of 2.0% compared with the previous year.

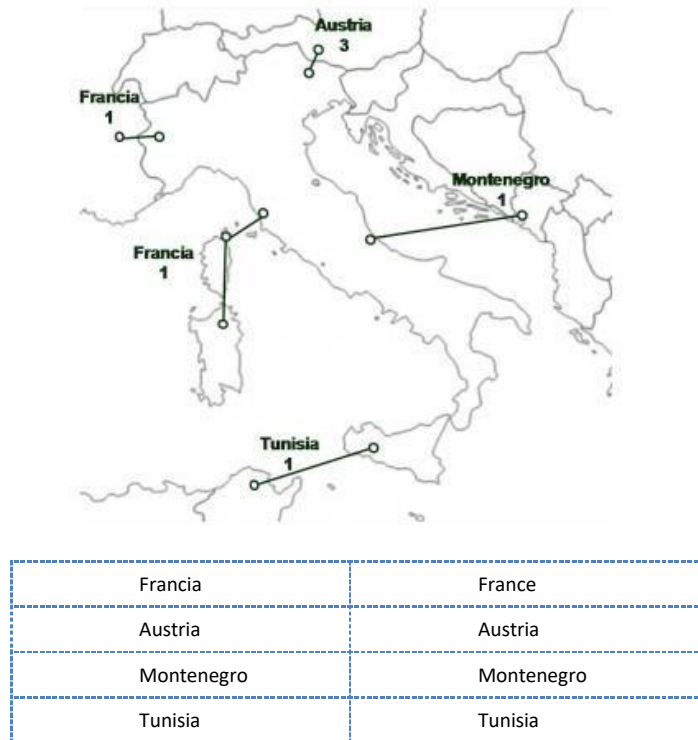
The national transmission network has 25 lines for foreign interconnections: four with France, 12 with Switzerland, two with Austria, two with Slovenia, two DC connections (a cable connection with Greece and a dual connection, called the ‘SACOI’ interconnection, between Corsica, Italy and Sardinia), a further AC cable between Sardinia and Corsica, and a 220 kV submarine and overland cable connection between Italy and Malta.

Figure 1 –Existing interconnections [Source: Terna – 2018 development plan]



In compliance with Terna’s concession obligations, the following interconnections are currently under construction or in the preliminary planning stage: the HVDC Piossasco-Grand’Ile connection (Italy-France), the 132 kV Prati di Vizzi/Brennero connection (Italy-Austria), the continental SACOI3 Sardinia-Corsica-Italy connection (Italy-France), and the Italy-Tunisia connection (ELMED project), and the HVDC Villanova – Tivat connection (Italia – Montenegro, currently ongoing).

Figure 2 – Interconnection projects planned by Terna [Source: Terna – 2018 development plan]



Furthermore, in implementation of the provisions of Law No 99/2009, Terna has identified, in collaboration with the TSOs of neighbouring countries, possible new interconnectors, financed (in whole or in part) by private parties selected on the basis of the provisions of the above Law. The projects of interest relate, in particular, to the borders with France, Switzerland, Austria, Slovenia and Montenegro.

Figure 3 – Interconnectors in development [Source: Terna – 2018 development plan]



Svizzera	Switzerland
Austria	Austria
Slovenia	Slovenia
Montenegro	Montenegro

A key issue in the electricity sector appears to be the use of these interconnections. Italy's net import-export of electricity in 2016-17 stood at around 37 TWh, which represents a decrease compared with the figures recorded over the previous five years, which consistently exceeded 40 TWh. The figure rose again, to about 44 TWh, in 2018. Without prejudice to the timeliness of market integration, Italy's future import-export balance might also be influenced by developments in the energy systems of those countries with which Italy has interconnections, in terms of decarbonisation objectives and changes in the energy mix. These aspects will need to be examined more closely, including on the basis of the final Energy and Climate plans of the other European countries.

With regard to the natural gas sector, Italy's consumption in 2017 totalled 75.1 billion Sm³, an increase of approximately 4.2 billion Sm³ (+6.0%) compared with 2016. Imports of natural gas in 2017 totalled 69.4 billion Sm³, representing approximately 92% of the total supply and with an increase in import demand of approximately 7% compared with the previous year, which equals 4.3 billion Sm³ in absolute terms. The increase in imports has helped to offset the reduction in domestic production, the total volume of which amounted to 5.2 billion Sm³ in 2017, a decrease of 5.9%.

Table 4 – Consumption of natural gas in Italy (billion Sm³ with a gross calorific value (GCV) of 10.6 kWh/Sm³)
[Source: Snam Rete Gas]

	2015	2016	2017	Absolute change 2017 vs 2016	% Change 2017 vs 2016
Imports	60.82	65.07	69.35	4.28	6.6%
Domestic production*	6.43	5.57	5.24	-0.33	-5.9%
Net balance of storage off-takes/in-puts**	-0.31	-0.2	0.2	0.4	-212.7%
Total availability of natural gas	66.94	70.44	74.81	4.38	6.2%
Exports***	-0.27	-0.26	-0.32	-0.06	22.6%
Gas in-put to the regional networks of other operators	0.05	0.04	0.03	-0.01	-19.0%
Other consumption****	0.80	0.71	0.63	-0.08	-10.7%

Total consumption in Italy	67.52	70.91	75.15	4.24	6.0%
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*Net of self-consumption of gas from wells

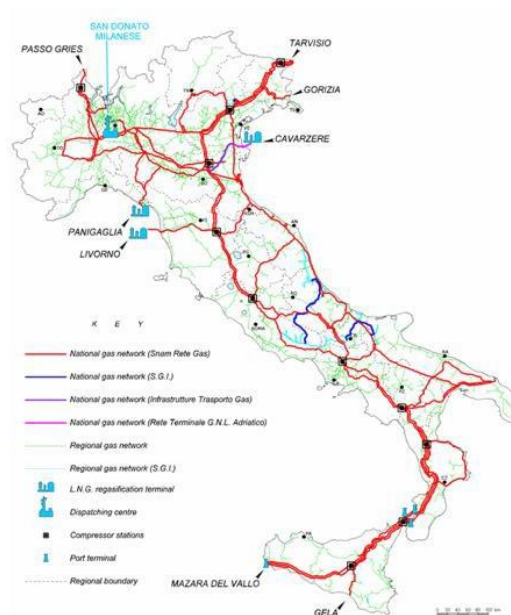
**Understood to be the balance of off-takes from storage (+) and in-puts to storage (-), expressed gross of consumption for injection/distribution

***Includes transits and exports to the Republic of San Marino

**** Includes consumption of LNG terminals, consumption of compressor stations for storage and stations for processing output

Gas imported from abroad is injected to the national network of gas pipelines through five entry points, corresponding to the interconnections with the import pipelines (Tarvisio, Gorizia, Passo Gries, Mazara del Vallo, Gela), and the LNG regasification terminals at Panigaglia, in the offshore facility in the northern Adriatic, and in the Tyrrhenian Sea, off the Tuscan coast.

Figure 4: Natural gas network infrastructure [Source: Snam Rete Gas]



The following projects, relating to the interconnection between the gas network and foreign countries, are worth mentioning:

- the conclusion of the project ‘Support for the north-west market and cross-border bidirectional flows’ in 2018, which allowed increased integration of the Italian market with other European markets, representing an enabling factor facilitating the alignment of prices between the various hubs (Project of Common Interest (PCI));
- works at an advanced stage of progress under the ‘TAP (Trans Adriatic Pipeline) interconnection’ project, aimed at connecting the new point of entry to the national gas pipeline network, by providing a maximum feed-in capacity of 46 MSm³/g;
- the interconnection project with Malta through the construction of a new pipeline starting from Gela (PCI); in 2018 the project was put forward for public consultation in Italy and Malta, with positive results;

iv. Administrative structure of implementing national energy and climate policies

The reform of Title V of the Constitution, and, in particular, Article 117, assigns the issue of ‘domestic production, transport and distribution of energy’ to the shared competences of the State and Regions.

The text of Article 117 of the Constitution assigned the following exclusive powers on issues relating to the energy sector to the State:

- relations with the European Union;
- protection of competition;
- protection of essential levels of service relating to civil and social rights;
- protection of public safety and security;
- protection of the environment and ecosystems;

Among the principles established by national law, the functions assigned to the Regions include the following:

- the drafting of regional energy policy objectives;
- the siting and construction of district heating plants;
- the development and enhancement of indigenous resources and renewable sources;
- the issuing of hydroelectric concessions;
- energy certification of buildings;
- the providing of conditions of security and environmental and regional compatibility;
- the security, reliability and continuity of regional supplies.

In addition, as a result of the three constraints on law-making common to both the State and the Regions, namely compliance with the Constitution, compliance with European Union law and compliance with international obligations, the Regions are called upon, jointly with the State, to achieve the binding targets on energy and climate identified by the European Union for 2020.

In the light of the objectives for 2030, and then for 2050, it is also necessary to encourage a more active role by those local and regional bodies that are closest to citizens. Specifically, this will be done by building on and strengthening the actions those bodies are taking forward in their own Action Plans for Sustainable Energy (APSEs) and Action Plans for Sustainable Energy and the Climate (APSECs), the operational instruments of the ‘Mayors’ Covenant’.

In the context of the ‘concurrent competences’ between State and Regions, and with due regard for the roles of the regulator, the network operators and market operators, and with a view to ensuring that the Plan is implemented correctly, a permanent technical office will be set up (INECP Observatory, which will absorb the existing Renewables Observatory). The role of the office will be to discuss, share and agree and cooperate on topics regarding the implementation of the Plan, with particular reference to the following:

- establishing implementation provisions and decrees for the transposition of the relevant European directives;
- reform to simplify authorisation procedures (dynamic repowering/revamping/permitting);

- monitoring the state of progress of the Plan objectives;
- developing plants, electricity grid and storage systems;
- coordinating, in a framework of overarching national rules, the promotion of recharging infrastructure for electric vehicles;
- checking and drafting improvement proposals, including in coordination with INECP environmental monitoring, regarding the arrangements and implementation times for the roadmap through which the effects of climate change will be integrated, in the two RCP 4.5 and 8.5 scenarios, in the first update of the INECP for 2023.

This observatory will be set up jointly by the INECP proposing ministries, by a representative of the Regions proposed by the Energy and Environment Coordination unit of the State-Regions Conference and by the National Association of Italian Municipalities (ANCI), by GSE (Gestore Servizi Energetici, the energy services operator) and by the Institute for Environmental Protection and Research (ISPRA). Its aim is to provide a forum for advanced technical discussion of the actual implementation of the Plan and the monitoring of its execution, prior to the official procedures established in the State-Regions or Unified Conference, and agreeing on and sharing any necessary adjustments to the INECP as it is implemented.

Each year the Observatory will draw up an implementation report that will be sent to the State-Regions Conference, the Prime Minister's Office and Parliamentary Committees 8 (environment) and 10 (productive activities) and to the ANCI.

The functions of the State primarily involve the Ministry of Economic Development, which has competence over energy (understood to mean both security and affordability of supply), the Ministry of the Environment as regards environmental aspects and climate change, and the Ministry of Infrastructure and Transport for functions relating to the transport sector, but also other relevant issues, such as, solely by way of example, large dams. There are also various other ministries that contribute towards attaining energy and climate objectives and towards implementing the measures relating to the five dimensions of energy.

The statistical surveying and monitoring function relating to the various subjects of the present plan plays an important role within this framework; this is because an accurate quantitative measurement of the structure and dynamics of the different components of the national energy system is an essential requirement, both in order to identify the specific measures to be carried out and to evaluate the relative results/impacts.

In the Eurostat/ EU context, moreover, the need to enhance energy statistics and extend their scope of reference to encourage and support policy decisions is now being recognised; solely by way of example, various task forces have been established with the mandate to identify new fields of investigation or to broaden existing ones, by developing a more detailed sectoral breakdown of energy consumption. In parallel to this, the regulations forming the basis of the statistical activities – beginning with EU regulations on energy statistics and directives dedicated to promoting renewable energies – are also continuously updated to include new scopes of application, new definitions and new accounting criteria.

To allow Italy to keep pace with this evolving scenario, provision has been made for specific resources to be allocated to the performance of periodical statistical surveys, on the basis of which a model of the structure and characteristics of energy consumption across different sectors (residential, tertiary, industrial, transport) can be developed using Eurostat harmonised procedures, definitions and methodologies.

The energy transition outlined in the INECP will be closely monitored, as will the state of implementation of the measures associated with the different dimensions of the Plan and the degree to which the objectives have been achieved. It will be vitally important to ensure that any trends providing evidence of the ongoing process can be used to provide public decision-makers with timely feedback on the efficacy of the measures and any need to update and fine-tune them, and on other factors that could determine the trajectory to follow to reach the targets. It will be equally important – as emerged from the public consultation – to provide all stakeholders with clear, timely and up-to-date information.

It will be particularly important to monitor the emissions targets resulting from national, European and international provisions and agreements. This will in part be done through the ‘National system for the creation of the national greenhouse gas inventory’ and the ‘National system for policies, measures and projections’ established, managed and updated by ISPRA in accordance with domestic legislation. It will also be done through pertinent communications, under Articles 7, 13, 14 and 15 of Regulation (EU) No 525/2013 (the Monitoring Mechanism Regulation, or MMR) and subsequently under Articles 18, 19(1) and 26 of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action.

The monitoring activity will be based on different sets of indicators that can measure the effectiveness of the policies and the degree to which the various targets have been reached, as well as economic aspects such as investment and employment impacts in the different sectors, in line with the work done by GSE on renewables and energy efficiency. To this end, for the purposes of the INECP Observatory and to provide timely, up-to-date information to citizens and central and local government bodies, GSE will set up a Plan-monitoring platform to which data and information from different sources will be channelled. This platform will also provide input data for the environmental monitoring plan, for the tasks for which the Ministry of the Environment and ISPRA are responsible in the communications sphere under the above-mentioned MMR and Governance Regulations, for the drafting of the annual report on the implementation of the Plan envisaged in the context of the INECP Observatory, and for the drafting of the two-yearly reports to be sent to the European Commission.

The implementation of national policies linked to the attainment of national objectives will also involve a number of other parties, operating in a manner compliant with European regulations. These parties include, first and foremost, the **Italian Competition Authority (AGCM)** and the **Regulatory Authority for Energy, Networks and the Environment (ARERA)**: in compliance with their independence from the executive, these authorities perform essential functions for protecting the interests of consumers and promoting competition, ensuring efficiency and the availability of services with adequate levels of quality, including in the energy sector, albeit with different roles, and, as regards the ARERA, for regulating a large number of the instruments linked to national energy policies.

Terna S.p.A. fulfils the role of national transmission system operator (TSO). Terna’s tasks include managing the high and very high voltage network, maintaining network infrastructure, planning for network development and construction, and dispatching, namely managing flows of electricity on the network, thereby ensuring that electricity demand and supply are in constant balance. These regulated services are performed as part of a monopoly on the basis of a government concession, under the supervision of ARERA.

Snam Rete Gas, as the leading company for natural gas transport, is responsible for the dispatching thereof throughout Italy and presents itself as an operator of the natural gas transport system in line with the system of ownership unbundling, in compliance with Legislative Decree No 93 of 1 June 2011, transposing Directive 2009/72/EC and Directive

2009/73/EC concerning common rules for the internal market in electricity and natural gas. The rules governing the access and use of the transport service on the network of gas pipelines owned by Snam Rete Gas, as well as the levels of quality of that service, are all laid down in a network code that is approved by ARERA, with the latter also determining the tariff system for the transport of natural gas, by establishing the criteria used to determine the tariffs for each regulatory period.

Of particular significance for the future, including in the light of the long-term strategy, is the strengthening of cooperation between Terna and Snam Rete Gas. The aim here is to coordinate the development of their 10-year plans on the basis of agreed scenarios that are consistent with the INECP and the long-term strategy. Another aim is to explore the possibility of integrating the electricity and gas systems for the purposes of the energy transition and the requirements related to the penetration of non-programmable renewables.

The electricity distribution network in Italy is currently split between 126 **distribution system operators (DSOs)**, which operate on the basis of concessions granted by the Ministry of Economic Development (62) and the Provinces of Trento and Bolzano (64). These operators differ greatly as a result of the size of the territory served and the reference benchmark and legal framework (municipalities, municipal utilities, types of companies). The ministerial acts of concession are published on the website of the Ministry of Economic Development; in addition, Terna publishes an up-to-date list of the distribution system operators and their associated identification codes, as well as an archive of the corporate changes made to these operators, on its website. The structure of the concession system for gas distribution is more complex, and is, moreover, undergoing a process of reorganisation.

The functions performed by **Gestore dei Servizi Energetici S.p.A. (GSE)**, a company owned entirely by the Ministry of Economic Affairs and Finance which operates in conformity with the strategic and operational guidelines defined by the Ministry of Economic Development and is responsible for managing and monitoring the support mechanisms for renewable energies – in the electricity, thermal and transport sector – and energy efficiency, are of particular relevance.

The GSE group is made up of the companies **Ricerca sul Sistema Energetico S.p.A. (RSE)**, **Gestore dei Mercati Energetici S.p.A. (GME, the Italian energy market operator)** and **Acquirente Unico S.p.A. (AU)**.

RSE is a company specialising in analysis, study and applied research covering the entire energy sector, with a particular focus on national strategic projects of general public interest, financed by the system research fund and international funding. The content of RSE projects mainly concerns the development of methods and technologies for producing sustainable energy, the distribution and storage of electricity, and scenarios for the energy system in line with the objectives and guidelines of national energy policy and the energy programmes of the EU.

GME is responsible for the economic organisation and management of the electricity market, environmental markets, natural gas and fuels in accordance with neutrality, transparency and objectivity criteria, and also manages the platform for registering fixed-term energy trade agreements concluded outside of the market.

AU performs the function of guaranteeing the supply of electricity to customers in the protected market (for as long as this market segment remains established), and manages a consumer help desk for providing support to end electricity and gas customers and a

mediation service for resolving disputes between customers and operators on behalf of ARERA. By way of the integrated information system (IIS), AU is also at the centre of information flows relating to the liberalised electricity and gas markets, with access to a database of off-take points and customers' identifying data. Finally, the company has also been assigned the functions and activities of the Italian Central Storage Entity (OCSIT) for the management of security oil stocks.

The **National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)**, a public-law body for research, technological innovation and the performance of advanced services in the sectors of energy, environment and sustainable economic development, is also supervised by the Ministry of Economic Development.

ISPRA, a public body which carries out research and testing, control, monitoring and evaluation, strategic consultancy, technical and scientific support, information, reporting, education and training activities in relation to environmental matters, with a focus on water protection, protection of the atmospheric environment, soil, subsoil, marine and terrestrial biodiversity and their respective crops, is, however, supervised by the Ministry of the Environment.

This is a necessarily complex system, therefore, which, in view of the 2030 objectives, suggests enhanced coordination for combined action in order to attain the objectives. In light of the shared competences established by the Constitution, this coordination primarily involves the State and the Regions.

A coordination procedure aimed at sharing and attaining the national objectives established at EU level has been trialled with reference to the 2020 objectives on renewable sources.

The Decree of the Ministry of Economic Development of 15 March 2012 (what is referred to as the 'burden-sharing decree') fixes the contribution which, without prejudice to the availability of State support measures, the various Autonomous Regions and Provinces are required to provide in order to attain the national objective, with each of those Regions and Provinces being given specific regional objectives for the use of RES by 2020. Each Region has also been provided with an indicative trajectory, which identifies intermediate objectives for the years 2012, 2014, 2016 and 2018. This approach, based on a distribution of effort between the various Regions, will also be proposed beyond 2020, in order to ensure sharing of objectives and to call on regional governments to contribute in a coherent manner to their attainment.

More generally, the aim is to create, with the additional support of the bodies listed above, a technical policy framework to give impetus to the implementation of the Energy and Climate Plan, which provides for the active involvement of the Ministries of Economic Development, the Environment and Infrastructure and the Autonomous Regions and Provinces; those other Ministries which perform, in various capacities, functions of direct benefit to the implementation of the measures will also naturally be involved in this undertaking, including the Ministries of the Economy, Cultural Heritage, Agricultural Policies, Education and Labour. The framework may also represent an interface for efficient dialogue with associations representing the interests of businesses and workers in the sectors concerned, so as to promote the measures through an approach that distributes the costs and benefits of the energy transition in a balanced manner. The INECP observatory, as described elsewhere, also provides input to that structure.

1.3 Consultations and involvement of national and Union entities and their outcome

i. Participation of the national Parliament

The consultation was not conducted using a pre-established format. It was based, instead, on the customary instruments for dialogue which were activated given that the draft Plan had been made available to the Speakers of the Chamber and Senate, the Department of Regional Affairs, the local authorities and the ARERA.

At the parliamentary level, as part of the examination Committee 10 of the Chamber (Productive Activities) conducted tens of hearings of stakeholders in the following categories:

- institutional (representatives of the main ministries involved and of the independent authorities operating in the sector, and representatives of the European Commission and Parliament);
- main public and private sector operators in the sector;
- main non-profit associations;
- consumers' associations;
- industry associations;
- associations of local public services agencies and companies operating in the electricity and gas sectors;
- experts from academia and research institutes.

After these hearings, tens of reports (produced by environmental and trade associations, businesses, research institutions and institutions) were filed.

In November 2019 the Minister for Economic Development (who submitted the draft INECP along with the Ministers for the Environment and for Infrastructure) reported to Chamber Committee 10 on the pathway followed and the underlying technical organisational structure. He then illustrated the key points of the public consultation, the discussion with the Regions and, not least, the recommendations of the European Commission. He set out the approaches adopted with regard to accepting certain proposals and with bringing the Plan into line with said recommendations.

In December 2019, as part of the debate on the conversion into law of the Climate Decree-Law, the Chamber of Deputies approved, with the favourable opinion of the Government, a number of motions tabled by members of different political groups, from both the majority and the opposition. For the matters most directly related to the Plan, these motions, albeit with different emphases and sensitivities, commit the Government to take action on a number of fronts to foster the energy transition. Common elements are the drive to energy transition, the circular economy and related requirements for the development of the production system, with due regard for economic and social sustainability, in some cases with agreement on carbon neutrality by 2050 and an invitation to strengthen the measures for the implementation of the INECP.

Although it is not a parliamentary body, it seems appropriate here to also mention the position paper produced by the Ministry of Agricultural, Food, Forestry and Tourism Policies. This document underscores the importance of the bio-energy sector, taking into

account their widespread availability (residual, agricultural and forestry biomass; cover crops; and second-harvest crops), the timeliness of exploiting them for energy uses, and the capacity to mitigate the effects of climate change through the CO₂ removals provided for by biomass supply chains. As regards electricity production, it is deemed that the current levels can be maintained until 2030. Turning to the production of thermal energy, the Ministry feels that a further growth in the input of bio-energy up to 2030, with respect to current levels, should be supported by encouraging increased forest growth. Lastly, as regards the transport sector, the Ministry deems that the conditions are right to make a determined effort to develop advanced bio-fuels and in particular agricultural and zootechnical biomethane.

ii. Involvement of local and regional authorities

By virtue of Italy's constitutional framework, the Regions have a fundamental role in achieving energy and climate targets. The role of the local authorities is equally significant.

The draft INECP was therefore discussed at length with the Regions and local authorities. This discussion took place in the context of the Unified State-Regions-Cities Conference, with the local authorities, and with the involvement of the Ministries of Economic Development, the Environment, and Infrastructure, all of the Regions (through energy and environmental experts) and the association of Italian municipalities. During the discussion, comments on and additions to the Plan, drawn up not least in the light of recommendations from the European Commission, were submitted and examined, for insertion in the final version.

In formal terms, the Unified Conference expressed its positive opinion on the INECP in Document No 137/CU of 18 December 2019.

Lastly, the Ministry of Economic Development opened a technical working group on the phase-out of coal from electricity generation. This was then divided up by electricity market area and a specific group for Sardinia was set up, with the involvement of all the Regions concerned and of operators and the social partners. Work on this issue, which is still ongoing, is intended to identify the conditions, accelerated pathways and arrangements for the phase-out, while keeping the system operating safely and securely and exploring solutions to address subsequent employment needs.

iii. Consultations of stakeholders, including the social partners, and engagement of civil society and the general public

Thematic expert groups

This consultation was intended to gather opinions, criticisms and proposals on the measures identified with reference to highly technical topics in the draft Plan, such as security, the market, research and competitiveness. Those invited to take part were experts, in some cases acting as third parties, such as independent authorities; and operators with public concessions, such as TSOs and distributors. Other participants were universities and research bodies operating in the sectors encompassed by the draft Plan, independent experts, workers' associations or other actors that do not have immediate and direct interests, such as particularly representative sector-based associations.

Participants in the thematic expert group, which received contributions from 30 respondents for a total of nearly 500 replies to the 49 questions drawn up on an ad hoc basis, could also take part in the public consultation.

Of the 485 replies provided, 45% concerned just two themes: electricity renewables and transport. The main observations that emerged included the need to promote storage to enable the participation of energy stocks and generated distribution in the balancing and dispatching market, the development of electric mobility and the advanced biomethane supply chain, and the use of market-based support instruments with a low impact on energy bills.

Online public consultation

A dedicated web portal was used to offer everyone (citizens, businesses, workers' associations, industry associations, non-profit organisations, professionals working in the sector, financial institutions and investment funds, etc.) including, when deemed necessary, those who had taken part in the thematic experts' groups, the opportunity to make observations, criticisms and proposals regarding the Plan.

The aim of the online consultation, which ran from 20 March to 5 May 2019, was to gather comments and proposals, especially on the measures identified in the draft Plan. Respondents could reply to just some of the questions if they wished, depending on the issues of greatest interest to them.

This was the consultation channel most widely used in this consultation on the draft Plan, thanks to the online accessibility provided by the portal set up by the Ministry of Economic Development for the INECP (energiaclima2030.mise.gov.it). It offered many points for analysis: a total of 207 respondents replied (of which 92 citizens and 115 associations, businesses and organisations), making nearly 3,500 responses to the 46 questions in the online public consultation format.

Of the 3,491 responses, 46% concerned three themes: large RES electricity plants, security and infrastructure, and thermal RES and energy efficiency.

The topics receiving most attention in the sections regarding electricity RES include the points made in favour of self-consumption, including on a collective basis, by enabling multi-user configurations in energy communities. Other topics stressed by respondents were the promotion of demand and supply aggregators in the context of power purchase agreements (PPAs) and the development of an environment that would enable the full development of storage technologies, especially through pumping and batteries but without neglecting the new power-to-gas frontiers. On the transport front, respondents called for measures to spur more electrification, in which a leading role is expected for smart recharging and vehicle-to-grid systems. They also wanted to see a streamlining of authorisation procedures and a single framework of reference, and a review of subsidies for fossil fuel sources with a view to gradually reducing them to improve the competitiveness of RES.

As regards the integration of RES at the local level, one point that emerged very clearly was the intention to conduct an accurate mapping exercise, jointly with the local authorities, of the existing potential and those areas most suited to energy production. The aim here is to share and analyse the extent of the areas available for future plants. As for the management of governance with the stakeholders involved, a unanimous convergence emerged towards a fuller, more informed involvement of citizens, drawing, for example, on the French 'débat public' experience, and an overall simplification and standardisation of the authorisation procedures connected with new installations or the revamping of existing ones.

On the topic of transport, respondents noted the need to protect the national biofuels supply chain, which mainly uses animal and vegetable oils and fats, and allow for an

increased use of biomethane in the transport sector. Other important aspects included the role of LNG in various economic sectors and the strengthening of the LPT offering in the light of the general growth in the many forms of sustainable collective mobility, with a preferential track for the expansion of electric vehicles.

Turning to the section on energy efficiency, respondents underscored the need to strengthen the mechanisms envisaged in the Plan to promote energy efficiency (tax deductions, White Certificates, Heating Account, National Energy Efficiency Fund). They focused on aspects linked to the energy and environmental performance of the measures. One suggestion was to develop specialised incentives that would be effective in given sectors, and thus avoid competition between and duplication of the various mechanisms. Respondents also placed importance on training and information measures and initiatives to encourage behavioural changes.

Consultation in the Strategic Environmental Assessment

With Directive 2001/42/EC, European legislation establishes the principle whereby all plans and programmes which are likely to have significant effects on the environment must be subjected to a Strategic Environmental Assessment (SEA) process.

The main objective of the SEA methodology is to 'provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development'.

In order to officially launch the SEA of the INECP, the ministries which collaborated on the draft Plan, namely the Ministry of Economic Development, the Ministry of the Environment and Protection of Natural Resources and the Sea and the Ministry of Infrastructure and Transport, were identified as the proposing authorities.

The procedure involved two stages of consultation.

- A consultation on the Preliminary Environmental Report (scoping report), which lasted 30 days and gathered observations and suggestions from 53 respondents with expertise in environmental matters.
- A public consultation on the scoping report, which was extended to government bodies and to the public. This consultation ran for 60 days and gathered observations from about 40 respondents.

Of the observations received during the public consultation on the Environmental Report, the following were worthy of note: consistency with regional environmental planning/programming; the need to propose criteria for the implementation of interventions throughout the country, compliance with which can be monitored; and the possibility of establishing sets of minimum indicators by type of measure (with standardised definitions and data-collection arrangements). In line with these observations, the Environmental Monitoring Plan, which, with a summary declaration, accompanies the INECP, was drawn up.

The environmental monitoring will follow the entire life cycle of the INECP and will make it possible to monitor progress towards achieving the environmental sustainability targets established during the SEA process. It will also make it possible to check for any significant

effects on the environment resulting from the implementation of the Plan, with a view to identifying any unexpected negative effects and adopting suitable corrective measures.

The effects to be monitored are, first, the overall positive effects on the environment: reduction in climate-changing emissions, improvement in air quality, reduction in the population's exposure to atmospheric pollution and to risk factors connected with climate change, improvement in the quality of life related to energy efficiency in buildings. Any negative effects on the environment that might result from the implementation of the measures in the different areas of the country, aggregated at Plan level, will also be monitored.

The environmental monitoring will be conducted through structured collaboration by the Ministry of the Environment and Protection of Natural Resources and the Sea, the Ministry of Economic Development, and the Regions and Autonomous Provinces, drawing on the resources of the system of environmental agencies and the Higher Institute for Environmental Protection and Research (part of the National System for the Protection of the Environment, SNPA).

This monitoring could provide input to the Integrated national energy and climate progress reports envisaged by Article 17 of Regulation (EU) 2018/1999 Governance, especially for the purposes of paragraph 1(e).

The Technical Committee for the Environmental Impact Assessment (EIA) and SEA performed the initial technical examination falling within its remit. It analysed and assessed the Plan and the environmental report and examined the observations, objections and suggestions received, and the opinions of the other administrations concerned and of other actors with competence for environmental matters. The technical examination concluded with Opinion No 3192 of 15 November 2019. The next step, on the basis of the outcome of the public consultation on the Environmental Report and the opinions expressed by the Ministry of Cultural Assets and Activities and of the competent authority, was to draw up the environmental monitoring plan referred to above as well as any resulting additions to the INECP. Of the latter, the following are worthy of note: a table relating the measures to the Plan objectives and targets, the inclusion of measures to reduce the consumption of land for new photovoltaic capacity, an improvement in the provision of the ecosystem service, policies to strengthen LPT, and integration with the National Atmospheric Pollution Monitoring Programme.

iv. Consultations with other Member States

In the course of 2019 the first consultations with neighbouring countries were opened. After the initial discussions, a joint meeting with the four countries of the eastern cross-border quadrant – Slovenia, Hungary, Croatia and Austria – took place in July 2019. Representatives of the European Commission also took part. In early September 2019 a meeting was held with representatives of Malta. A process of dialogue and collaboration was thus initiated that will continue into 2020 and beyond.

In addition, on 26 November 2019 a Memorandum of Understanding was signed by the Italian Minister for Economic Development and the Greek Deputy Minister for Energy and the Environment with the aim of fostering energy cooperation between the two countries. The agreement is intended to establish a common framework of reference for Italy and Greece to promote industrial partnerships focusing on sustainability and on the diversification and security of energy supplies. It also envisages a further strengthening of

collaboration by the gas and electricity transmission and distribution system operators of the two countries, through new strategic industrial partnerships.

v. Iterative process with the Commission

Italy took an active part in all meetings of the Technical Working Group on NECPs that took place between 2018 and 2019, during which a discussion with the European Commission and the other Member States on the individual points making up the National Plans was established. In this setting the Commission deemed the Italian INECP to be at a good stage of development. During the meetings, Italy was often held up as an example of good practice and was invited to set out its approach on various spheres and dimensions.

Along with its Communication of 18 June 2019 containing an assessment of the draft Plans submitted by Member States to implement the objectives of the Energy Union, which was published in the Official Journal on 3 September 2019, the Commission issued specific recommendations for individual Member States.

In the case of Italy, the Commission recommended the adoption of detailed and quantified policies and measures that are in line with the obligations set out in Directive (EU) 2018/2001, to enable the goal of a 30% renewable energy share for 2030 to be achieved in a timely and cost-effective manner. It also recommended an Increased level of ambition for renewables in the heating and cooling sector to meet the indicative target included in Article 23 of the Directive. A further request was that Italy put forward more detailed measures to meet the target for the use of renewables in the transport sector.

As regards energy efficiency, Italy was asked to ensure that the policy instruments illustrated in the draft INECP would still deliver adequate savings in the period 2021-2030. The Commission also recommended a special effort on strengthening energy efficiency measures for buildings (new and existing public and private buildings) and in transport, sectors in which there could be significant untapped potential.

In terms of air quality and emissions, Italy was asked to clarify how it intends to comply with the 'no-debit rule' in the Land Use, Land Use Change and Forestry (LULUCF) context and to provide a quantitative analysis of the interactions with air quality and emissions policy.

Turning to security, Italy was asked to provide further information on how it would reconcile the central role of gas with decarbonisation, on the state of progress of certain gas infrastructure and on measures to increase diversification and reduce energy dependency on other countries

As for the market dimension, the Commission asked Italy to establish measures to achieve the objectives of flexibility, market coupling and a reduction in the price differential and to assess the impact on prices of the capacity market and support for RES.

Lastly, in the sphere of regional cooperation Italy was asked to consult neighbouring countries on Central and South-Eastern Europe Gas Connectivity (CESEC) and on coordinated policies for energy supply in the Adriatic and in the Mediterranean region. A further request was to list actions undertaken and plans to phase out energy subsidies for fossil fuels.

Those topics on which recommendations were made were incorporated in the additions made to the text of this document in the course of 2019, also taking into account any new legislative provisions, both national and European, introduced over the last year and the outcome of the consultation on the draft Plan.

1.4 Regional cooperation in preparing the plan

i. Elements subject to joint or coordinated planning with other Member States

The meeting of 4 July 2019, as referred to in point iv. of the previous section, found that it would be opportune to intensify the dialogue in the following spheres:

- CESEC group;
- new projects and infrastructure in the Adriatic.

As regards the topics that emerged for further bilateral discussion by the countries involved, the following lines of collaboration were identified:

- exchange of good practice and cooperation on alternative fuels in the transport sector, on RES and on energy efficiency;
- small islands as 'laboratories' for the development of RES;
- testing of smart grids;
- new cross-border infrastructure projects;
- efficient integration of electricity markets and governance;
- shared and agreed risk management plans for the electricity and gas system;
- energy poverty;
- development of hydrogen.

An initial technical meeting with Malta took place on 11 September 2019 with the aim of exchanging best practices and identifying topics of potential common interest. The discussion identified the following areas of common interest:

- prospects for the development of the Italian electricity market;
- gas price projections;
- exchange of best practice for the development of biomethane in Italy;
- metering methodology for renewable cooling systems;
- indicative target for RES in the heating and cooling sector;
- potential development of innovative renewable energy projects using European funds;
- potential interest in statistical transfers of renewable energy.

As regards enhanced energy cooperation with Greece, see point iv. of the previous section.

ii. Explanation of the way in which the plan takes regional cooperation into consideration

The topics mentioned above are some of the existing points of contact between different countries' draft Plans. It will soon be necessary to examine with the other Member States the possibility of developing joint or synergistic projects on these themes. On the basis of these initial meetings, Italy has assessed with interest the following topics:

- energy supply infrastructure and offshore installations in the Adriatic on which the joint interests of several countries could converge;
- policies for the sustainable development of energy supplies in the small islands, with exchanges of good practice;
- policies and measures to mitigate energy poverty (e.g. Slovenia);

- the development of the use of hydrogen (e.g. Austria).

For other projects (statistical transfers, common RES projects at sea, etc.) initiatives to be developed in the coming years at bilateral level will be identified as work progresses. Some trials of this nature are undergoing initial assessment in the context of achieving the targets to 2020, in which context some countries have explored Italy's willingness to engage in statistical transfers, that is, to hand over Italy's probable surplus with respect to meeting its own objective for the share of consumption met by RES by 2020.

2 NATIONAL OBJECTIVES AND TARGETS

2.2 Dimension decarbonisation

2.1.1 Greenhouse gas emissions and removals²

i. Elements set out in the first paragraph of Article 4(a)

(1) With respect to greenhouse gas emissions and removals and with a view to contributing to the achievement of the greenhouse gas emission reduction target throughout the Union:

i) the Member State's binding national target for greenhouse gas emissions and the annual binding national limits pursuant to Regulation (EU) 2018/842;

ii) the Member State's commitments pursuant to Regulation (EU) 2018/841;

iii) where applicable to meet the objectives and targets of the Energy Union and the long-term Union greenhouse gas emissions commitments consistent with the Paris Agreement, other objectives and targets, including sector targets and adaptation

The target of reducing greenhouse gas emissions by at least 40% at European level by 2030 compared with 1990 is shared amongst the ETS sectors (energy industries, energy-intensive industrial sectors and aviation) and non-ETS sectors (transport, residential, tertiary, industry not included in the ETS sector, agriculture and waste), which will need to record a -43% and -30% decrease, respectively, compared with 2005.

Greenhouse gas emissions (GHG) from energy uses represent 81% of the national total, which equalled approximately 428 million tonnes of CO₂ equivalent [MTCO₂eq] in 2016 (national inventory of greenhouse gas emissions, excluding the balance of forestry emissions/removals). The remaining share of emissions derives from non-energy sources, which are mainly associated with industrial processes, fluorinated gases, agriculture and waste.

The following table gives an overview of the weighting of each sector in terms of GHG emissions (MTCO₂eq) in the period 2005-2016.

² Consistency to be ensured with long-term strategies pursuant to Article 15.

Table 5 – Evolution of emissions by sector in the period 2005-2016 (GHG emissions, MTCO₂eq)
 [Source: ISPRA]

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
FROM ENERGY USES, of	480.2	471.6	463.5	454.2	408.6	417.2	404.7	387	360	345.1	352.5	347.1
which:												
Energy industries	161.3	161.9	161.6	158.1	133.4	134	132.7	128.3	108.8	100.2	105.8	104.4
Industry	83.9	78.9	75.7	72.3	55.8	62.6	61.5	55.6	51.6	52.6	50.9	47.9
Transport*	128	129.2	129.2	122.2	116.5	115.2	114.1	106.5	103.8	108.6	106	104.5
Residential and commercial	86.9	82.6	78.7	83.7	85.1	87.8	79.2	80.1	79	67.4	74.1	74.7
Agriculture	9.3	9.1	8.7	8.4	8.5	8.1	7.9	7.6	7.5	7.5	7.7	7.8
Other	10.7	9.8	9.5	9.5	9.3	9.5	9.3	8.9	9.1	8.7	8	7.8
FROM OTHER SOURCES, o	100.7	95.8	96.5	92.5	86.8	86.8	86.7	84.6	81.3	80.2	80.3	80.8
which:												
Industrial processes/fluorinated gases	46.7	42.8	43.1	40.6	35.4	36.4	36.6	33.8	32.8	32.4	32.3	32.1
Agriculture	32.1	31.7	32.4	31.4	30.8	30.1	30.3	30.9	29.7	29.2	29.4	30.4
Waste	21.9	21.4	21	20.5	20.6	20.4	19.8	19.9	18.7	18.5	18.6	18.3
TOTAL	580.9	567.4	559.9	546.6	495.4	504	491.4	471.6	441.2	425.3	432.9	427.9
Of which subject to the ESR	330.5	320.9	315.1	314.6	299.3	301.5	291.2	282.9	274.4	270.4	274.5	270.6

*Data on navigation refers to national vessels and movements in ports, international vessels are excluded

While the target for ETS sectors is set at European level, as it is a system applied to all Member States on a harmonised and centralised basis, the target of reducing greenhouse gases relating to sectors falling under the Effort Sharing Regulation is split between the various Member States.

Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement (the Effort Sharing Regulation, ESR) sets Italy a reduction target of -33% compared with 2005 levels for non-ETS sectors. This target must be achieved by following a linear reduction trajectory that will identify an emissions limit for each year.

In order to attain the ESR target, the Member States may, within certain limits, use flexibilities that allow them to manage the reduction trajectory (intra-period banking and borrowing transactions) and carry out transfers of its emission allocation with other Member States. In addition to this, Member States are also given a further degree of flexibility associated with the accounting of net removal of CO₂ equivalent (CO₂eq) by the forestry sector (Regulation (EU) 2018/841 – Land Use, Land Use Change and Forestry (LULUCF) Regulation). This operation is allowed on the condition that the commitments undertaken pursuant to the LULUCF Regulation are upheld, namely that the neutrality between emissions and removals on the national territory be ensured (what is referred to as the ‘no debit’ rule). In any event, the cumulative quantity taken into account for Italy for all the years of the period from 2021 to 2030 may not exceed the maximum amount of total net removals, namely 11.5 MTCO₂ eq.

The following table gives a quantitative indication of the national situation with respect to the targets agreed at European level for 2020, and the target for 2030.

Table 6 – ETS and ESR emissions targets

	Target for 2020	Scenario for 2020:	Target for 2030	Scenario for 2030:
ETS emissions	-21%	-42%	-43%	- 55.9%*
ESR emissions	-13%	-21%	-33%	- 34.6%*

* Possible reductions if the expected benefits of the implementation of all of the policies and measures listed in Chapter 3 below of the present plan materialise

With reference to 2020, the projections show that Italy has substantially exceeded the level of reduction expected for emissions in both the ETS and non-ETS sector. In particular, the most recent data available from the 2016 national inventory, greenhouse gas emissions for the non-ETS sector, show a reduction of approximately 18% compared to 2005, which should increase to approximately -21% by 2020, thus representing an ‘over-achievement’ of 246 MTCO₂eq cumulative for the overall period 2013-2020.

With regard to the 2030 target, the decrease in emissions compared with the aggregated European target for the ETS sector, which benefited from the phase-out of coal in thermoelectric production and the ever increasing use of renewables in the electricity sector, is confirmed.

With reference to the non-ETS sector, in order to comply with the emissions trajectory for the period 2021-2030, which should lead to a 33% reduction compared with 2005 levels, a minimum cumulative reduction of emissions of approximately 142 MTCO₂eq compared with the reduction achievable with existing policies will be needed, which reduction will primarily be achieved in the transport, civil and industrial sectors.

The following figure shows the projected emissions trend for non-ETS sectors if the expected benefits of the implementation of all of the policies and measures listed in Chapter 3 below of the present Plan materialise. The following table provides details by individual sector.

Figure 5 – Historical emissions trend in non-ETS sectors and future scenarios on the basis of current policies and the INECP (MTCO₂eq) [Source: ISPRA]

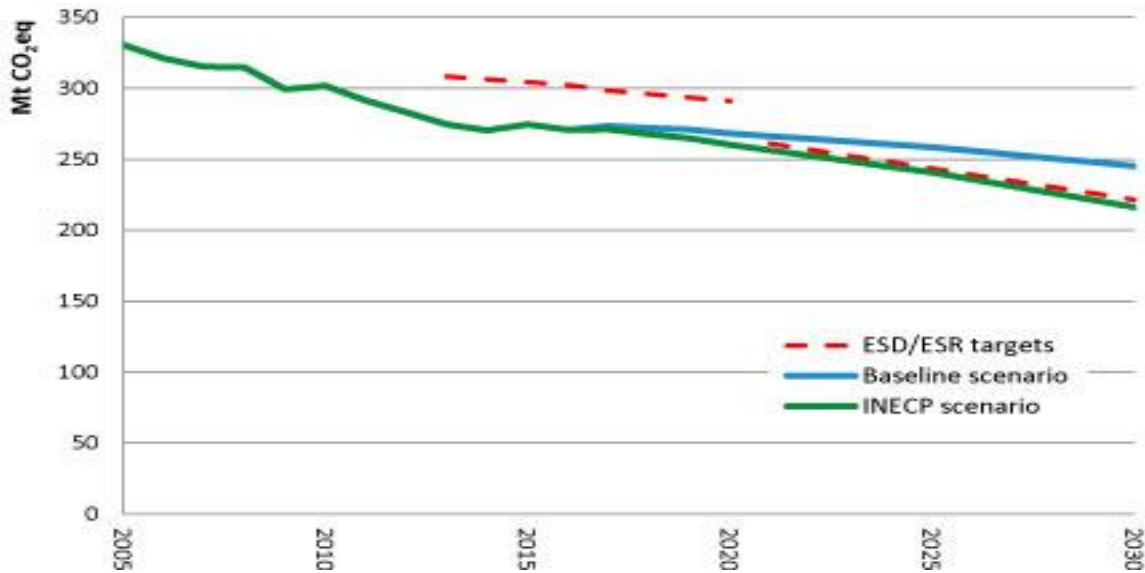


Table 7– Historical emissions trend in non-ETS sectors and future scenarios on the basis of current policies and the INECP (MTCO₂eq)

Year	2005	2015	2020		2025		2030	
Sector	scenario				scenario		scenario	
	Baseline	INECP	Baseline	INECP	Baseline	INECP	Baseline	INECP
Industry (including process and fluorinated gases)	55	42	42	41	39	37	36	34
Civil	87	73	72	72	67	61	65	52
Agriculture (energy consumption)	9	8	8	8	7	7	7	7
Transport	125	103	100	95	101	92	93	79
Agriculture (livestock/crops)	32	29	31	31	31	31	31	31
Waste	22	19	16	16	14	14	13	13
Total	330	274	268	263	258	242	245	216
Target -33% by 2030			291	291	243	243	221	221

Looking at the details provided for the individual sectors, the most significant contribution comes from the transport and civil sectors (residential and tertiary).

In the civil sector, the reduction in emissions for 2030 compared with 2005 in the scenario for the INECP totals approximately 35 MTCO₂eq and reflects the expected acceleration in the process for increasing the efficiency of pre-existing buildings, enhanced by the increase in complete renovation measures and the application of particularly high-performing technologies.

For the transport sector, the impact on emissions (with a reduction of approximately 46 MTCO₂eq in the INECP scenario compared with 2005) can be mainly attributed to developments in shared/public mobility and the gradual roll-out of vehicles characterised by a reduced energy consumption and very low or zero CO₂ emissions, as well as the gradual and natural renewal of the vehicle fleet. Emissions from energy uses of fossil fuels are compounded by emissions from non-energy sources which, however, will make a relatively modest contribution to the decarbonisation process.

Emissions from industrial processes are essentially attributed to cement, lime and steel productions and fluorinated gases. Although the former emissions are not easily reduced, as they are directly proportional to the quantities produced, they are, however, already quite low following a prolonged period of economic downturn. By contrast, a limiting effect will be exerted on fluorinated gases following the full transposition of Regulation (EU) 517/2014, which establishes, amongst other things, a ban on the use of some gases with a high global warming potential and their replacement with products that have a smaller climate impact.

In the waste sector, emissions are primarily linked to the total quantity produced, the portion of biodegradable substances sent to landfill and the percentage recovery of methane from landfill gas. A relatively significant reduction in emissions is expected here, equal to approximately 9 MTCO₂eq, which should be achieved through the gradual implementation of pre-approved waste management plans and objectives. National legislation has set a very ambitious target of achieving 60% sorted waste collection by 2030, which represents the main driving force behind waste management policies in Italy. Thanks to this target, which has not yet been reached consistently throughout the country, it has been possible to achieve high percentages for the recycling of urban waste that are perfectly in line with the 2020 EU recycling target of 50%.

In the agricultural sector, emissions mirror trends in factors such as the number and type of livestock animals, changes in cultivated areas, and types of crops, as well as the use of fertilisers containing nitrogen. These variables are sensitive to changes in agricultural practices, as outlined in the common agricultural policy and rural development plans. Over the last ten years, this sector has nevertheless shown a relatively stable trend in terms of emissions, which has only been marginally influenced by biogas production and reductions in/changes to the use of fertilisers. The sector is expected to record an overall reduction of approximately 2 MTCO₂eq.

With reference to the forestry sector, the contribution is limited by the provisions on LULUCF flexibility contained in the ESR Regulation (11.5 MTCO₂eq for the entire 2021-2030 period) and by what is known as the 'no debit' rule of the LULUCF Regulation (Regulation (EU) 2018/841). Over the last 25 years, changes in soil use in Italy have led to an increase in forest areas (+23%), wetland (+2%) and settled areas (+42%), with a reduction in grazing areas (-5%) and cropland (-18%) compared with 1990 also being observed. Italy has a rich biological and forestry heritage with various different types of landscapes (ranging from continental to Mediterranean). The surface area of land in Italy falling under the 'forest' category was approximately 7 590 kha in 1990, 8 369 kha in 2000, 9 032 kha in 2010, and 9 305 kha in 2015, equivalent to 31% of the total national surface area.

The following table shows greenhouse gas removals and emissions from the LULUCF sector in KTCO₂eq, estimated using the Intergovernmental Panel on Climate Change (IPCC) methodology, as reported to the European Commission within the framework of the monitoring mechanism (MMR) for greenhouse gas emissions (Regulation (EU) 525/2013).

Table 8 – Projections for LULUCF categories (KTCO₂eq) [Source: ISPRA]

	2005	2015	2020	2025	2030	2035
LULUCF (Land Use, Land Use Change and Forestry)	-28,383	-39,379	-25,980	-22,767	-23,429	-26,228
Forest areas	-34,477	-39,922	-27,519	-23,075	-22,749	-24,382
Cropland	1,459	2,160	1,059	975	891	806
Grazing areas	-2,643	-6,926	-4,341	-4,478	-4,785	-5,096
Wetland	8	130	167	230	292	355
Settled areas	7,801	4,956	4,561	3,902	3,244	2,585
Other areas	0	0	0	0	0	0
Products of forest management	-531	223	93	-321	-321	-497

Viewed over a longer timescale, these emissions/removals figures give an idea of the road that will need to be followed after 2030 to complete the transition to climate neutrality. In line with the framework outlined, those sectors where emissions are hardest to reduce will need to be tackled, especially those with ‘non-energy’ sources (starting with industrial processes and agriculture). At the same time, it will also be necessary to make a push to complete the decarbonisation of ‘energy uses’ (including the most widespread, such as transport). This outlook is consistent with the long-term strategy, which envisages the application of new technologies, the gradual upgrading of energy infrastructure and changes in citizens’ behaviour/habits.

ii. Where applicable, other national objectives and targets consistent with the Paris Agreement and the existing long-term strategies. Where applicable for the contribution to the overall Union commitment of reducing the GHG emissions, other objectives and targets, including sector targets and adaptation goals, if available

The National Strategy on Adaptation to Climate Change, adopted by Director’s Decree No 86 of 16 June 2015, outlined a national framework for the impacts of climate change on environmental processes and resources and the socio-economical systems of Italy, and drew up a national vision of the pathways to follow in order to address those impacts.

The implementation of the strategy triggered the process for drafting the National Plan on Adaptation to Climate Change (PNACC). Within the scope of the plan, a contextual analysis of the current and future climate condition and a description of the degree of risk to the national

territory and the expected impacts on the sectors defined in accordance with the strategy were developed. Possible actions for adaptation at a national level and instruments for monitoring and evaluating their effectiveness were also identified.

A process for auditing and revising the plan, which involved sharing its content with the ministries, Regions and research bodies, preparing a scientific review, and holding two public consultations, was launched in 2017. The National Plan on Adaptation presents itself as an instrument for supporting national, regional and local institutions in defining their adaptation pathways, including in relation to the specific characteristics of the territories. It represents a shared basis for analysis methodologies, information and data. On the basis of Director's Decree No 86, the content of the plan must be agreed upon during the State-Regions Conference.

Following the example of the European Climate-ADAPT platform and in collaboration with the Institute for Environmental Protection and Research (ISPRA), work also commenced on the creation of an adaptation web platform, with the aim of disclosing, raising awareness of and making available the data contained in the PNACC and other operational instruments to all citizens, and in particular in order to support the decision-making process of local authorities. The platform includes a document section containing information and data from various statistical and scientific sources, and in particular climate data monitored by the national system for environmental protection. The platform will also provide users with a geoprocessing module with additional processing and analysis functions and will contain information on best practices at national and international level.

On the basis of the data and analyses contained in the PNACC, the climate impacts on the energy system can be grouped into the following aspects.

- Physical vulnerability: risks associated with the increased intensity and frequency of extreme weather events, namely the climate changes currently being experienced: drought, floods, landslides, overflowing rivers, etc. These risks are also directly linked to energy infrastructure, in terms of both installations and transmission and distribution networks.
- Operational vulnerability: the impact that quantitative changes in hydrological cycles, their seasonal variations, the increases in average temperatures and changes to wind conditions have on energy delivered and on the energy balance of installations (EROEI – energy returned on energy invested) and on the technical characteristics of wind turbines.
- Impacts on demand: changes in energy demand for cooling buildings as a result of climate changes, as highlighted in the various evolution scenarios taken into consideration in the PNACC. Changes in the demand of crop cycles and cultivation methods must also be taken into consideration in the agricultural sector.

Consequently, in order to create a resilient energy system that remains reliable through short- and mid-term climate scenarios and is able to continuously evolve, even in long-term scenarios, account must be taken of the above impacts, by means of:

- promoting the development of micro grids and smart grids to encourage high-efficiency self-generation in urban communities and industrial districts, with due regard for the security of the system and preferably using the existing network;
- implementing programmes and instruments for managing and guiding demand (demand-side management);

- promoting the application, across all sectors, of best available technologies (BAT) for managing energy efficiency;
- improving interconnections with European networks to offset the use of discontinuous renewable sources;
- using an energy mix that guarantees the ability to adapt to extreme climate situations in order to maintain the continuity of energy supply;
- evaluating, monitoring and verifying the resilience of the energy system following the execution and implementation of the INECP.

In any event, pending the establishment of the new energy structure to reduce the risk posed to continuity of supply, plans on the resilience of the electricity networks have already been introduced in Italy, to be periodically drafted and implemented by distribution system operators, with a similar obligation also being placed on transmission system operators. The risks and magnitude of negative events will be reduced in this way, starting with the most vulnerable regions.

2.1.2 Renewable energy

i. The elements set out in the second paragraph of Article 4(a)

(2) With respect to renewable energy:

With a view to achieving the Union's binding target of at least 32% renewable energy in 2030, as referred to in Article 3 of Directive (EU) 2018/2001, a contribution in terms of the Member State's share of energy from renewable sources in gross final consumption of energy in 2030, with an indicative trajectory for that contribution from 2021 onwards. By 2022, the indicative trajectory shall reach a reference point of at least 18% of the total increase in the share of energy from renewable sources between that Member State's binding national target for 2020 and its contribution to the 2030 target. By 2025, the indicative trajectory shall reach a reference point of at least 43% of the total increase in the share of energy from renewable sources between that Member State's binding national target for 2020 and its contribution to the 2030 target. By 2027, the indicative trajectory shall reach a reference point of at least 65 % of the total increase in the share of energy from renewable sources between that Member State's binding national target for 2020 and its contribution to the 2030 target.

By 2030, the indicative trajectory shall reach at least the Member State's planned contribution. If a Member State expects to surpass its binding national target 2020, its indicative trajectory may start at the level it is projected to achieve. The Member States' indicative trajectories, taken together, shall add up to the Union reference points in 2022, 2025 and 2027 and to the Union's binding target of at least 32% renewable energy in 2030. Separately from its contribution to the Union target and its indicative trajectory for the purposes of this Regulation, a Member State shall be free to indicate more ambitious targets for national policy purposes;

Italy plans to pursue the target of obtaining 30% of gross final consumption of energy from renewable sources in 2030 by defining a pathway of sustainable growth for renewable sources and the full integration thereof into the system. In particular, the target for 2030 projects a gross final consumption of energy of 111 Mtoe, with approximately 33 Mtoe of that coming from renewable sources. The evolution of the share of renewable sources follows the minimum indicative trajectory identified in the second paragraph of Article 4(a) of the Governance Regulation.

Figure 6 – Trajectory of overall RES share [Source: GSE and RSE]

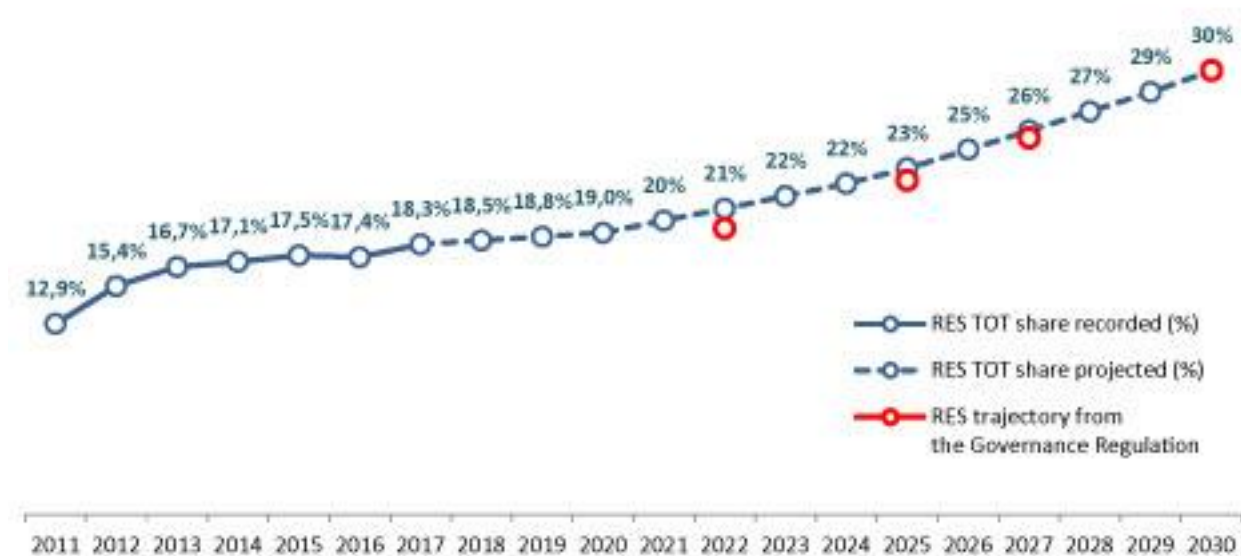


Table 9 – Overall RES target for 2030 (ktoe)

	2016	2017	2025	2030
Numerator	21,081	22,000	27,168	33,428
Gross production of electricity from RES	9,504	9,729	12,281	16,060
Final consumption of RES for heating and cooling	10,538	11,211	12,907	15,031
Final consumption of RES in the transport sector	1,039	1,060	1,980	2,337
Denominator – Overall final gross consumption	121,153	120,435	116,064	111,359
Overall share of RES (%)	17.4%	18.3%	23.4%	30.0%

The allocation of the numerator between the sectors shown in the table is indicative and may be revised during the drafting of the final plan. That figure of 29.7% emerging from the scenario involving targets is not to be regarded as conflicting with the 30% contribution made by Italy towards achieving the EU target.

ii. Estimated trajectories for the sectoral share of renewable energy in final energy consumption from 2021 to 2030 in the electricity, heating and cooling, and transport sector

Without prejudice to the statement made at the end of section i. above (which applies to all of the following information, including section iii.), the contribution of renewables to meet total gross final consumption by 2030 (30%) is expected to have the following distribution between the different sectors:

- 55.0% renewables share in the electricity sector;
- 33.9% renewables share in the heating sector (for heating and cooling);
- 22.0% with regard to the incorporation of renewables in the transport sector (calculated using the target accounting criteria established by RED II).

Figure 7 – Trajectory of total RES share [Source: GSE and RSE]

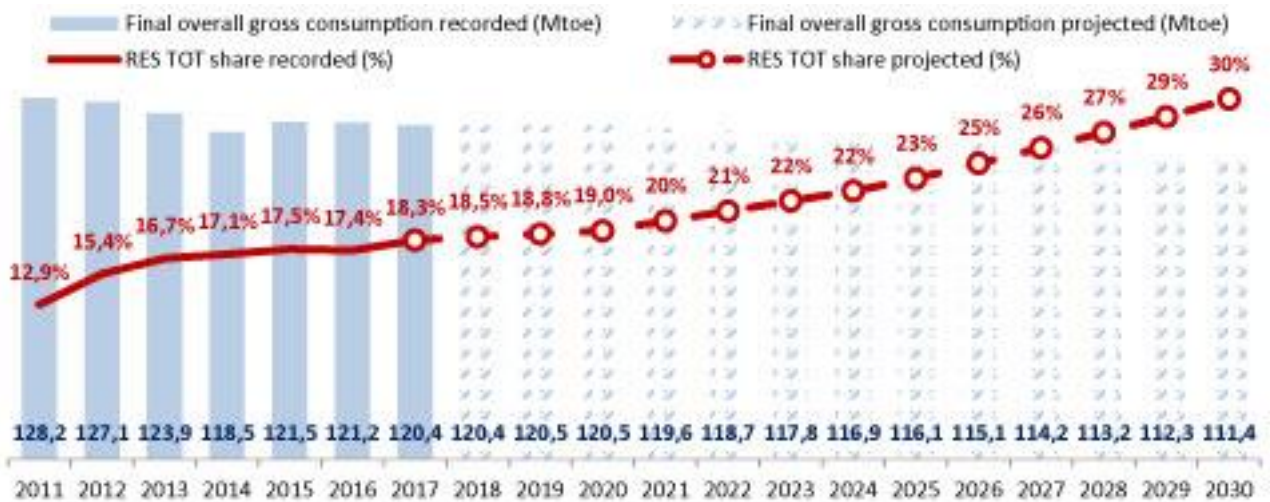


Figure 8 – Trajectory of electric RES share [Source: GSE and RSE]

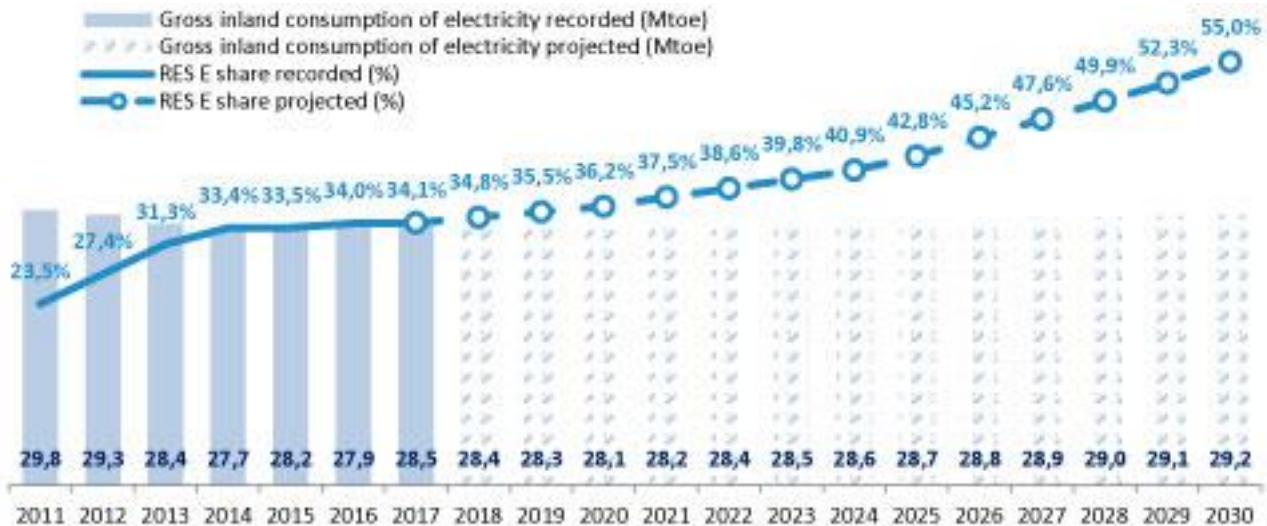
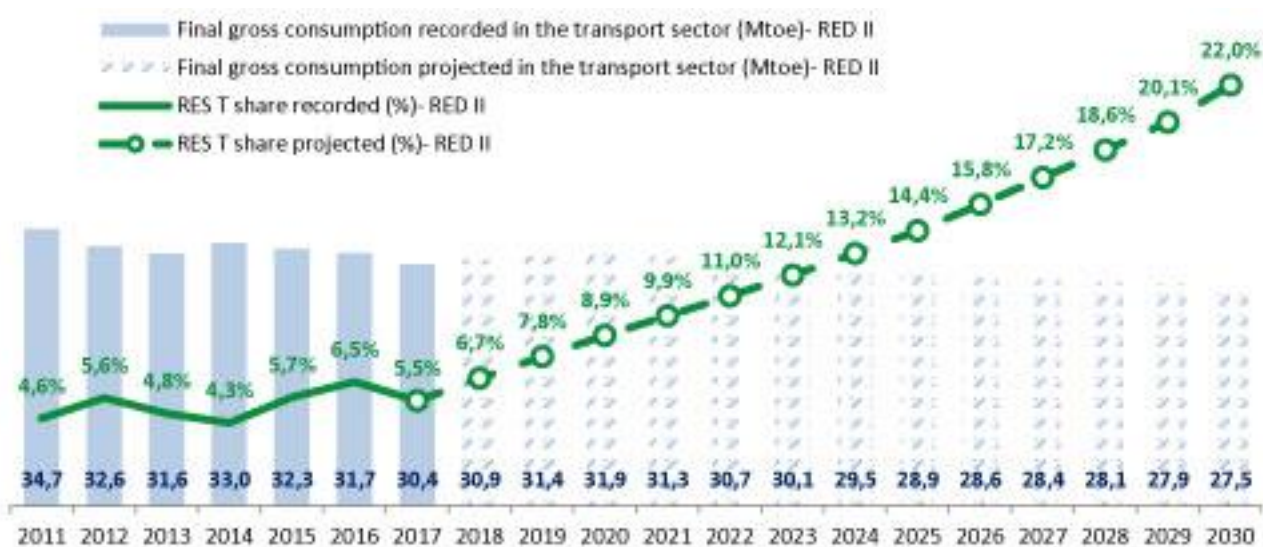


Figure 9 – Trajectory of RES share in the heating sector [Source: GSE and RSE]



Figure 10 – Trajectory of RES share in the transport sector [Source: GSE and RSE]



iii. Estimated trajectories by renewable energy technology that the Member State projects to use to achieve the overall and sectoral trajectories for renewable energy from 2021 to 2030, including expected total gross final energy consumption per technology and sector in Mtoe and total planned installed capacity (divided by new capacity and repowering) per technology and sector in MW

Electricity sector

According to the objectives of the present plan, electricity production facilities are undergoing a major transformation thanks to the target of phasing out coal-fired generation by as early as 2025 and the promotion of the widespread use of renewable energy sources.

The greatest contribution to the growth of renewables will come from the electricity sector itself, which will achieve 16 Mtoe generation from RES, equal to 187 TWh, by 2030. The significant penetration of technologies for renewable electricity production, primarily photovoltaics and wind power technology, will enable the sector to cover 55.0% of gross final electricity consumption with renewable energy, compared with 34.1% in 2017. The significant technically and economically feasible growth potential of photovoltaic installations and wind parks, thanks also to the reduction in costs associated therewith, points to a major development of these technologies, the production of which should triple and more than double, respectively, by 2030.

In order to attain the targets on renewables identified for 2030, it will not only be necessary to stimulate new production, but also to preserve existing production and, if possible, actually increase it, by promoting the revamping and repowering of installations. In particular, the opportunity to promote investments in the revamping and repowering of existing wind power plants with more developed and efficient machines, by exploiting the excellent wind conditions at well-known sites that are already being used, will also help to limit the impact on soil consumption.

A similar approach, based on a reduction in soil consumption, will be followed in order to guide the expansion of the significant growth capacity of photovoltaics that is projected for 2030, by promoting their installation primarily on buildings, roofs, car parks, service areas, etc. In order to attain the 2030 targets, it is nevertheless still vital to promote large ground-mounted photovoltaic installations, with priority being given, however, to unproductive areas that are not earmarked for other uses, such as areas not usable for agriculture. In this light, installations in former artificial areas (with reference to the National System for the Protection of the Environment (Italian initials SNPA) classification), preference should be given to contaminated sites, waste disposal sites and areas along the infrastructure system.

With regard to other sources, consideration is given to a limited growth scenario for extra geothermal power and hydropower and a slight decrease in bioenergy, net of bioliquids, in respect of which, by contrast, a gradual decrease is expected until the end of the incentive period.

In the case of large hydropower plants, there is no doubt that these represent a resource that is already largely being exploited, albeit predominantly strategically, in policies for 2030 and in the long-term for 2050, the production of which needs to be safeguarded and increased.

Table 10 – Growth targets for power (MW) from renewable sources for 2030

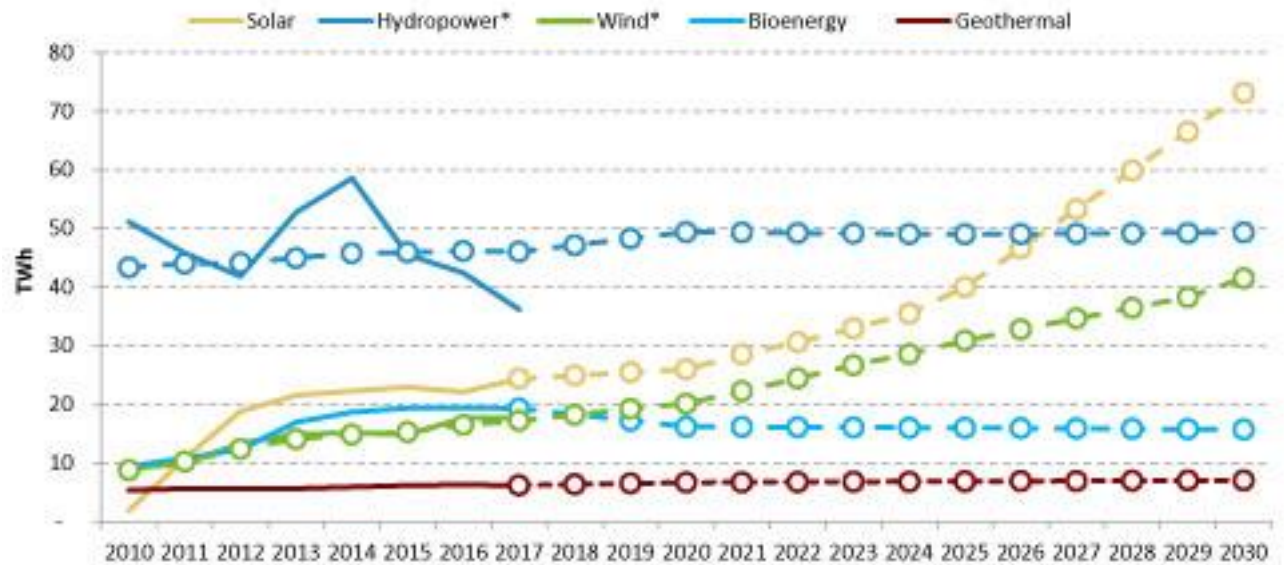
Source	2016	2017	2025	2030
Hydropower	,641	18,863	19,140	19,200
Geothermal	5	813	920	950
Wind	10	9,766	15,950	19,300
of which off-shore	0	0	300	900
Bioenergy	124	4,135	3,570	3,760
Solar	,269	19,682	28,550	52,000
of which concentrated solar power (CSP)	0	0	250	880
Total	,258	53,259	68,130	95,210

Table 11 – Growth targets and trajectories for 2030 for the renewables share in the electricity sector (TWh)

	2016	2017	2025	2030
Renewable production	110.5	113.1	142.9	186.8
Hydropower (actual)	42.4	36.2		
Hydropower (normalised)	46.2	46.0	49.0	49.3
Wind (actual)	17.7	17.7		
Wind (normalised)	16.5	17.2	31.0	41.5
Geothermal	6.3	6.2	6.9	7.1
Bioenergy*	19.4	19.3	16.0	15.7
Solar	22.1	24.4	40.1	73.1
Denominator – Gross inland consumption of electricity	325.0	331.8	334	339.5
RES-E share (%)	34.0%	34.1%	42.6%	55.0%

* For bioliquids (included under bioenergy, together with solid biomass and biogas), only the contribution from sustainable bioliquids is given.

Figure 11 – Growth trajectories for electricity from renewable sources for 2030 [Source: GSE and RSE]



*For production from hydro and wind sources, for the period 010-2017 both the actual figure (continuous line) and the normalised figure are given, according to the rules established by Directive 2009/28/EC. For bioliquids (included under bioenergy, together with solid biomass and biogas), only the contribution from sustainable bioliquids is given.

Heating sector

The heating sector plays a very important role in attaining renewables targets; in fact, what is needed is a decisive shift in technology towards solutions that facilitate the penetration of renewable sources. In absolute terms, consumption from renewables is expected to surpass 15 Mtoe in the heating and cooling sector, an increase which is primarily linked to the increase in renewable energy provided by heat pumps.

The development of the heating RES sector is influenced by environmental issues associated with the impacts of emissions from pre-existing solid biomass-fired heating systems. Therefore, the installation of new biomass-fired heating systems must be targeted towards promoting high-efficiency systems meeting high environmental quality standards, with consideration also being given to the possibility of introducing restrictions on new systems in areas characterised by critical air quality conditions. In order to stimulate the renewal of old systems using efficient, low-emission technologies, more stringent performance requirements on accessing incentives for biomass-fired heat generators will be introduced in the short term.

In this respect, the replacement of domestic wood-fired systems with more efficient, lower-emission systems that meet the highest environmental classification standards (Ministerial Decree No 186/2017) will be encouraged. The possibility of developing measures to finance technological innovation and research for this type of system is also being examined, with a view to further improving energy and environmental performance. It is recommended that a meeting be arranged with the Commission to discuss whether, on the basis of current statistical rules, the greater efficiency of the new systems, which reduce the quantity of biomass used, will, paradoxically, make it more difficult to attain the targets.

Another aim is to encourage, from a circular economy perspective, the use of agricultural waste, not least to prevent it from being burnt in the fields, as is at present common practice and, with due regard for the European rules, promote the use of local biomass. A short traceability supply chain would be adopted that meets criteria of sustainability and produces an environmental and social balance that is on the whole favourable.

Considering the high efficiency of heat pumps, these will gain an increasing weight in the thermal renewables mix, additionally supported by the technological progress in the sector, in which the different performance levels and characteristics of electric and gas pumps will be compared.

An increase in the thermal RES share will also be achieved thanks to extensive renovation of the existing building stock, which will result in a significant decrease in consumption.

Thermal solar energy may play a growing role in integrated systems for efficient and renewable heat production, such as, for example, hybrid systems and the integration of district heating systems.

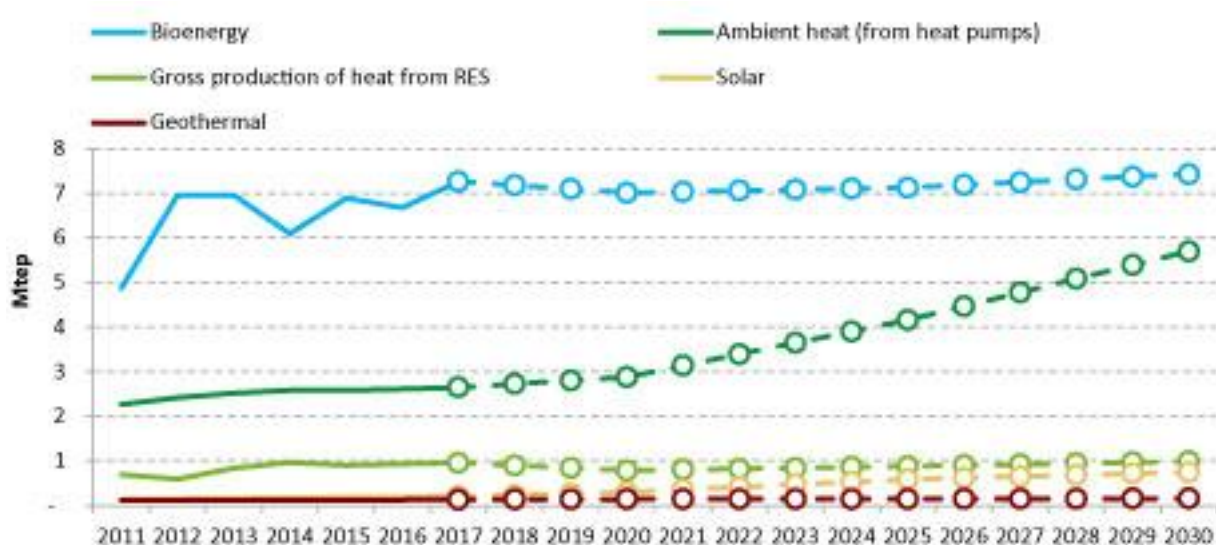
Provision is made for a development margin for district heating; in order to exploit this potential, it will be vitally important to take advantage of the synergies between the use of renewable energy sources and HEC, in consideration of the specific climate and technical and economic conditions.

Table 12 – Renewables targets in the thermal sector (ktoe)
sustainable bioliquids is given.

	2016	2017	2025	2030
Numerator	10,538	11,211	12,907	15,031
Gross production of heat from RES*	928	957	881	923
Final consumption of RES for heating	9,611	10,254	12,026	14,038
of which bioenergy*	6,677	7,265	7,128	7,430
of which solar	200	209	590	751
of which geothermal	125	131	148	158
of which ambient energy from heat pumps	2,609	2,650	4,160	5,699
Denominator – Gross final consumption in the heating sector	55,796	55,823	47,126	44,350
RES-C share (%)	18.9%	20.1%	27.4%	33.9%

* For bioliquids (included under bioenergy, together with solid biomass and biogas), only the contribution from sustainable bioliquids is given.

Figure 12 – Growth trajectories for energy from renewable sources for 2030 in the heating sector [Source: GSE and RSE]



Transport sector

The recast Renewable Energy Directive (RED II) identifies a specific target for the transport sector of 14% for 2030 (obligation for suppliers of fuels and electricity). In order to contribute to the challenging general target of 30% total gross final consumption met by RES, it is expected that the transport sector will surpass the value of 14% by increasing the obligation imposed on suppliers of fuels and electricity for the transport sector up to a renewables share of 22.0%.

The role of RES in the transport sector is of significance when calculating the overall renewables target, insofar as, with a view to optimising system costs, the use of biofuels appears to be very cost effective. The optimum mix for attaining the renewable fuels target appears to be the recommended contributions for the different types of renewable sources listed below.

- First generation biofuels: in accordance with the Directive, a decrease for this category of biofuel is projected, in order to reach a contribution of approximately 0.7 Mtoe, equal to 3%, by 2030; the possibility of introducing lower limits for some types of fuel, especially those that could lead to an indirect change of end-use for the land, will be assessed.
- Advanced biofuels: the specific target identified by the Directive, equal to 3.5% by 2030, is expected to be surpassed through the incentivisation mechanism established for biomethane and other advanced biofuels (by Ministerial Decree of 2 March 2018, and subsequent decrees) in order to attain a target of around 8%.
- As a guideline, 75% of the target for advanced biofuels will be attained through the use of advanced biomethane (0.8 Mtoe) and 25% through the use of other advanced biofuels (0.26 Mtoe), without prejudice to any changes to the allocation caused by the actual availability and affordability of the different types of advanced biofuel and by reaching the maximum share of biomethane that can be used in the transport sector. For advanced biomethane originating from agricultural waste and the organic fraction of municipal solid waste (OFMSW), the target of at least 1.1 billion m³ by 2030 is confirmed.
- Biofuels listed in Part B of Annex IX (waste vegetable oils and animal fats): the Directive imposes an upper limit of 1.7%, with Member States being allowed to increase that value if fully justified. An increased upper limit of 2.5% is proposed, with a final contribution of up to 5% (using double counting). This goal must be achieved using waste vegetable oils (used cooking oils – UCOs), and with priority being given to UCOs collected in Italy, with due regard for the circular economy principle and in line with the new objectives of the waste package. The possibility of increasing the ceiling of 1.7% for biofuels, as referred to in Annex IX, part B, will be assessed, also taking into consideration animal fats classified as category 1 or 2 under Regulation (EC) 1069/2009, in cases where the entire production, collection and treatment chain is Italian.
- electricity from RES consumed in the road sector: e-cars will account for approximately 0.404 Mtoe, which, multiplied by 4 (multiplication factor), will cover approximately 6% of the target RES for the transport sector;
- a significant contribution from electric vehicles and plug-in hybrid electric vehicles (PHEV), which appear to be a solution for private urban mobility capable, just like e-cars, of contributing to improved integration of production from electric renewables, is also expected for 2030. Investments in this kind of vehicle are expected to be particularly effective in 5-7 years, with almost 6 million electrically powered vehicles in overall circulation by 2030, approximately 4 million of which will be all-electric vehicles. The aim is to introduce compulsory quotas of electric vehicles specifically for public transport.
- electricity from RES consumed in the rail and other transport sector: this consumption will account for approximately 0.313 Mtoe, which, multiplied by 1.5 (multiplication

factor), represents approximately 2% of the target RES for transport. Initiatives in this segment, which is the most energy-efficient mode of transport for people and goods, along with transport by sea, will be a priority.

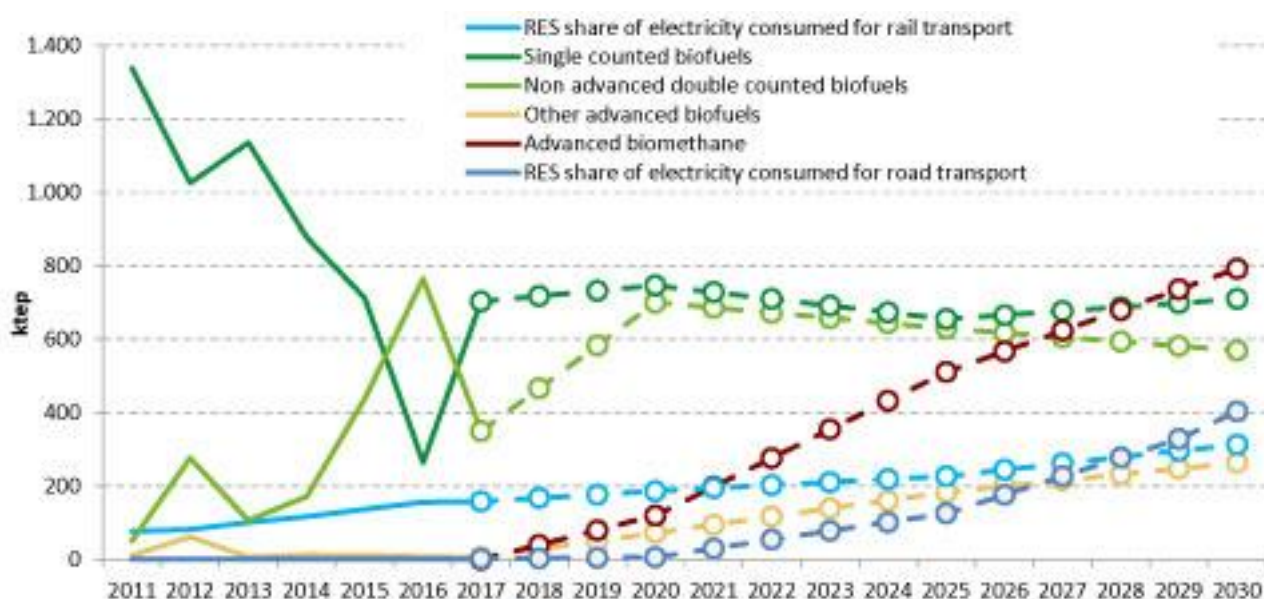
- non-biological renewable fuels: a contribution is projected for hydrogen, of around 1% of the target RES for the transport sector, through its direct use in cars, buses, heavy goods vehicles and trains (non-electrified for certain routes) and eventually sea transport, or through the in-put into the network of methane, including for transport uses. An indication of differentiated use might be 0.8% input, mixed with natural gas, into the gas network, as is, and/or converted back into methane, and 0.2% for direct use in cars, buses and trains. The plan is also to promote – starting with research, development and demonstration activities – the production and use of hydrogen produced by renewable electricity. This offers the double advantage of reducing emissions from fuel and other refining products, while at the same time making it possible to store excess renewable electricity generated when supply exceeds demand. This is also important from the long-term perspective of the ‘climate neutrality’ objective. Again with a view to developing the use of hydrogen in the transport sector, integrated multi-fuel distribution solutions using fuel cells could play an important role.
- aviation and maritime biofuels: a contribution, also from renewable gas, which, however, currently appears difficult to quantify, is projected;
- recycled fossil fuels (for example plastic from sorted waste collection or fuel obtained through CO₂ recovery from steelworks): the contribution to the RES target for the transport sector will be identified once the ‘GHG saving’ values have been published by the European Commission (expected by 2021 by the Directive) after the minimum sustainability requirements for these fuels have been identified.

Table 13 – Projected contribution of renewables in the transport sector by 2030, according to the criteria defined in RED II for calculating the obligations for fuel and electricity suppliers (ktoe)

	Multiplication factor*	2016	2017	2022	2025	2030
Numerator		2,056	1,665	3,365	4,152	6,051
Advanced biofuels	X 2	9	7	394	695	1,057
of which biomethane	X 2	0	0	277	511	793
of which other biofuels	X 2	9	7	117	184	264
Non-advanced double-counted biofuels	X 2	765	350	672	630	570
Single-counted biofuels		265	703	710	655	710
Renewable share of electricity for road transport	X 4	2	2	55	126	404
Renewable share of electricity for rail transport	X 1.5	156	159	203	228	313
Denominator – Gross final consumption in the transport sector		31,719	30,352	30,655	28,851	27,472
RES-T share (%)– RED II		6.5%	5.5%	11,0%	14.4%	22.0%

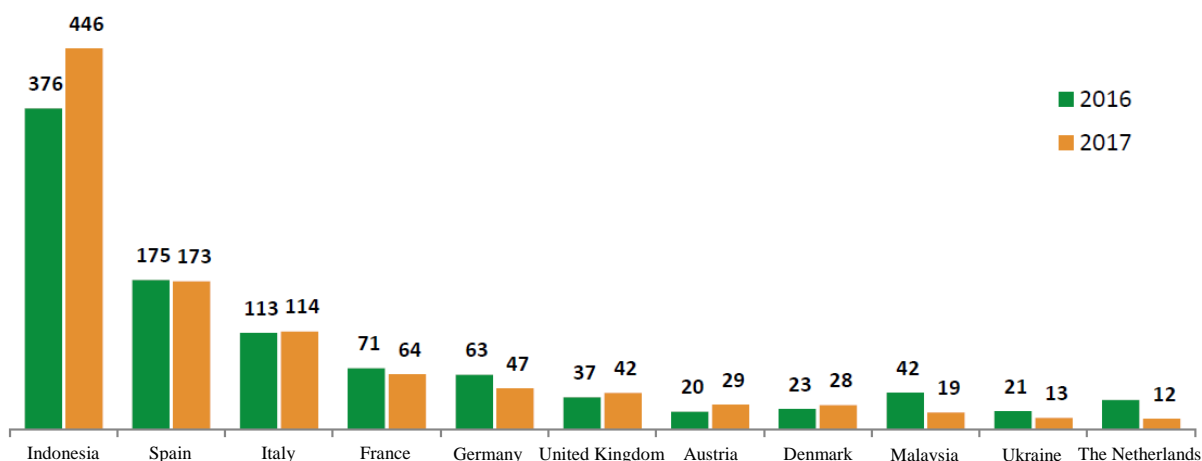
- The contributions of the individual components are shown without applying the multiplication factors. The overall numerator, however, is obtained taking the multipliers into account.

Figure 13 – Growth trajectories for energy from renewable sources by 2030 in the transport sector [Source: GSE and RSE]



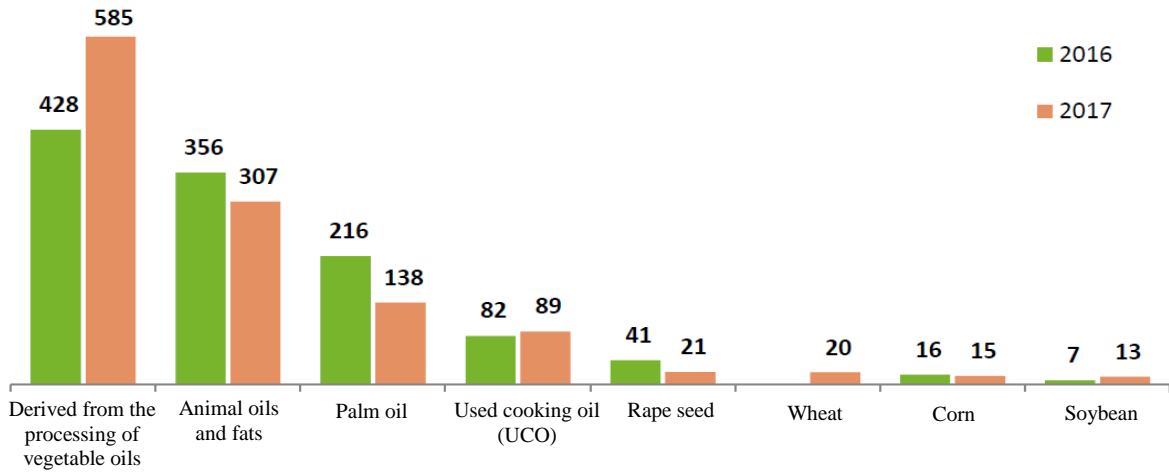
With regard to the place of production for biofuels, it is worth mentioning that 27.5% of sustainable biofuels in-put for consumption in 2017 was produced in Italy; the sharp reduction compared with the same share recorded in 2016 (30.4%) is primarily to be attributed to reduced levels of biodiesel in domestic production (-28,000 tonnes).

Figure 14 – Place of production of biofuels consumed in Italy in 2016 and 2017 (thousands of tonnes) [Source: GSE]



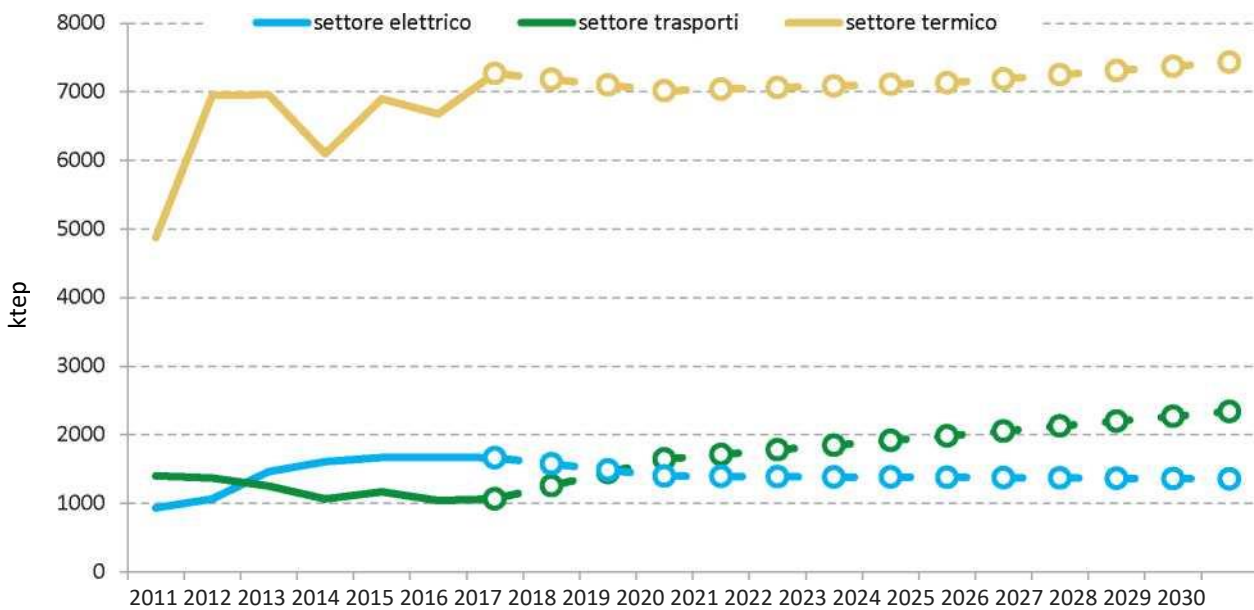
By way of information, the following figure shows the main raw materials used to produce sustainable biofuels in-put for consumption in Italy in 2016 and 2017.

Figure 15 – Raw materials used to produce biofuels consumed in Italy in 2016 and 2017 (thousands of tonnes)
 [Source: GSE]



iv. Estimated trajectories of bioenergy demand broken down by heating, electricity and transport and biomass supply broken down by raw material and origin (with a distinction being made between domestic production and imports). For forest biomass, assessment of the origin and impact on the LULUCF sink

Figure 16 – Growth trajectory for the contribution of bioenergies in the different sectors in order to achieve the RES target for 2030 [Source: GSE and RSE]



With regard to biomass supply and the origin thereof, approximately 80% (in energy content) of biomass is domestic in origin. In light of the stabilisation of consumption, this percentage should remain steady, or else slightly decrease, as a result of the projected increased degree of penetration of more highly efficient technologies, with the possibility of increasing the share of pre-processed fuels, such as pellets.

In the electricity sector, by contrast, a significant decrease in imports of bioliquids is expected in light of the objective to gradually phase out this supply, which should be offset by a greater domestic contribution, in particular by residues and by-products, in compliance with the criteria of a circular economy.

The estimates for the transport sector, where the growing role played by renewable electricity and advanced biofuels and of renewable gas should, however, increase the share of raw materials from domestic and European sources, are more complex.

v. Where applicable, other national trajectories and objectives, including those that are long term or sectoral (share of renewable energy in district heating, renewable energy use in buildings, renewable energy produced by cities, renewable energy communities and renewables self-consumers, energy recovered from the sludge acquired through the treatment of wastewater)

Italy is highly invested in the development of self-generation systems, in particular in buildings (it is recalled that, for new buildings and buildings undergoing significant renovations, there is already an obligation to integrate a minimum renewables share), and in the development of energy communities. A study, financed by the Commission's Structural Reform Support Service (SRSS), is currently under way that will contribute towards a better definition of the most appropriate policies, and therefore specific and achievable targets.

2.2 Dimension energy efficiency

i. The elements set out in Article 4(b)

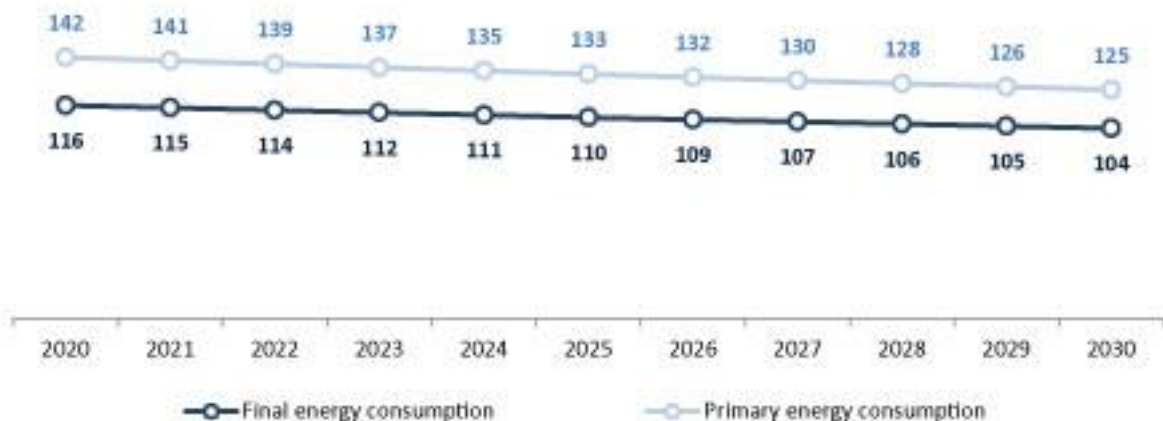
(1) the indicative national contribution towards energy efficiency needed to attain the Union's targets of at least 32.5% energy efficiency in 2030, as set out in Article 1(1) and Article 3(5) of Directive 2012/27/EU, on the basis of primary or final energy consumption or primary or final energy savings or energy intensity; Member States shall express their contribution in terms of absolute level of primary energy consumption and final energy consumption in 2020, and in terms of absolute level of primary energy consumption and final energy consumption in 2030, with an indicative trajectory for that contribution from 2021 onwards. They shall explain their underlying methodology and the conversion factors used;

Italy intends to pursue an indicative reduction target for 2030 of 43% for primary energy consumption and of 39.7% for final energy consumption, with respect to the reference PRIMES 2007 scenario.

In terms of the absolute level of primary and final energy consumption for 2020, it is estimated that the indicative targets set pursuant to Directive 2012/27/EU, equal to 158 Mtoe and 124 Mtoe, respectively, will be surpassed.

By contrast, with regard to the absolute level of energy consumption for 2030, Italy is pursuing a target of 125.1 Mtoe of primary energy and 103.8 Mtoe of final energy, following the trajectory indicated in the following figure, starting with the estimated consumption for 2020.

Figure 17 – Trajectory of primary and final energy consumption (Mtoe) in the period 2020-2030 [Source: RSE]



In order to set this target, a trajectory based on attaining the savings obligations defined pursuant to Article 7 of the Energy Efficiency Directive (EED) of 11 December 2018, which provides for a minimum target reduction in final consumption of 0.8% per year for the period 2021-2030, calculated on the basis of the three-year period 2016-2018 (with estimates being

made for 2017 and 2018), was developed. The proposed scenario also works on the assumption that the targets relating to renewable sources and decarbonisation will be attained.

(2) the cumulative amount of end-use energy savings to be achieved over the period 2021-2030 under Article 7(1)(b) on the energy efficiency obligation schemes pursuant to Directive 2012/27/EU;

Pursuant to Article 7(1) of the EED, the energy savings targets set for each Member State to be attained between 1 January 2021 and 31 December 2030 are equivalent to a minimum of 0.8% per year of the average final energy consumption in the years 2016, 2017 and 2018.

The first step needed to calculate the savings target involves identifying the amount of final energy consumed nationally during the aforementioned years. Where available (2016 and 2017), statistical data from Eurostat (Final Energy Consumption Europe 2020-2030 – FEC2020-2030), were taken into consideration, while for 2018, an estimate based on the TIMES model, developed by Italy for the purposes of the present plan, was used.

The following table shows data relating to the situation in Italy, on the basis of the calculation.

Table 14 – Final energy distributed and average final energy during the three-year period 2016-2018 (data given in Mtoe) [RSE calculations on the basis of data from Eurostat]
given in Mtoe) [RSE calculations on the basis of data from Eurostat]

	2016	2017	2018
Final energy consumption	115.9	115.2	116.5
Average for the three-year period 2016-2018	115.9		

On the basis of the average final energy consumption during the three-year period 2016-2018, it is possible to calculate the annual saving of 0.8% to be attained during the period 2021-2030 and, consequently, the cumulative saving to be attained by 31 December 2030. These values are provided in the following figure.

Table 15 – Savings to be attained during the period 2021-2030 on the basis of the average final energy consumption during the three-year period 2016-2018 (data given in Mtoe)

Year	Annual saving	Annual energy savings										TOTAL	
2021	0.8%	0.927											0,927
2022	0.8%	0.927	0.927										1,854
2023	0.8%	0.927	0.927	0.927									2,781
2024	0.8%	0.927	0.927	0.927	0.927								3,707
2025	0.8%	0.927	0.927	0.927	0.927	0.927							4,634
2026	0.8%	0.927	0.927	0.927	0.927	0.927	0.927						5,561
2027	0.8%	0.927	0.927	0.927	0.927	0.927	0.927	0.927					6,488
2028	0.8%	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927				7,415
2029	0.8%	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927			8,342
2030	0.8%	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	0.927	9,269
TOTAL cumulative saving during the period 2021-2030												50,977	

Therefore, it is estimated that new measures will produce a 0.927 Mtoe incremental saving of final energy per year for the period 2021-2030, which is primarily attributable to the civil and transport sectors.

In terms of the overall cumulative amount, this translates into a 50.98 Mtoe saving of final energy to be attained through active policies during the period 2021-2030.

Therefore, in order to comply with the obligation, a reduction in final energy consumption of nearly 9.3 Mtoe/year by 2030 through active policies is required, to be attained primarily in non-ETS sectors.

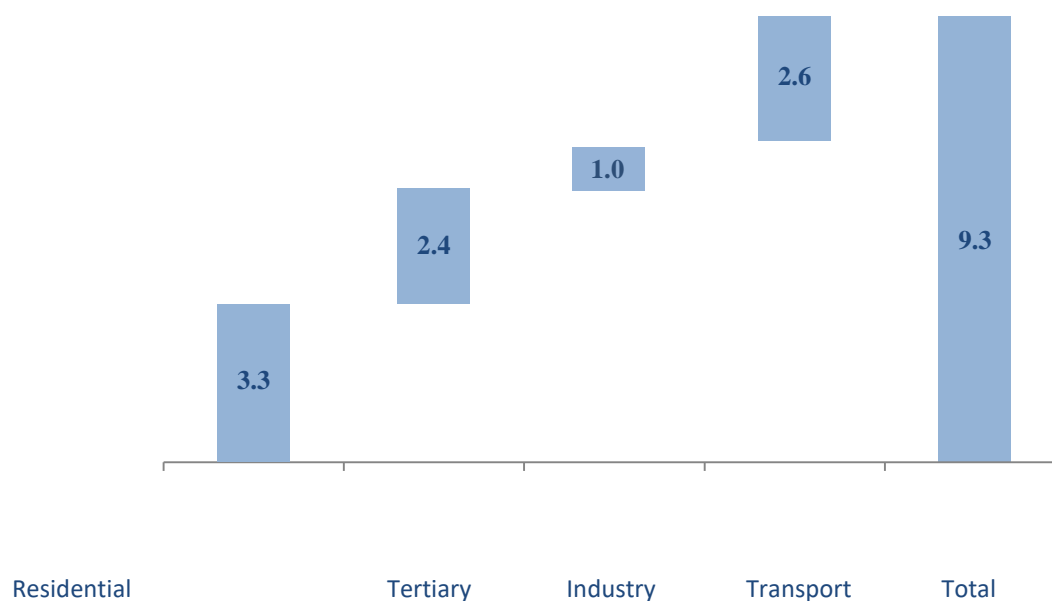
Although the calculation of the annual saving set out in the previous table on the basis of the latest available data shows a minimum reduction target of 50.98 Mtoe from 2021 to 2030 (which corresponds to an annual saving of about 9.25 Mtoe by 2030), the target already set

out in the draft INECP, of about 51.4 Mtoe (an annual saving of over 9.35 Mtoe by 2030) is confirmed.

Italy has decided not avail itself of the options referred to in Article 7(2) of the EED for 2021-2030.

The figure below shows the estimated annual savings forming the subject of the 2030 target by sector.

Figure 18: Distribution of the savings forming the subject of the 2030 target by economic sector (Mtoe)



The distribution of sectoral contributions, which must be regarded as indicative, is the result of the modelling approach employed: with a view to minimising system costs, the sectors with higher efficiency potential and measures with an appropriate level of cost effectiveness were identified, in order to ensure that the objective of the Energy Efficiency Directive is met. The sectoral distribution is influenced by developments in the performance levels and costs of energy technologies, the potential of the sector, and the renewables target, which leads to options, such as heat pumps, which facilitate the attainment of the renewables targets, being favoured.

The civil sector, along with transport, is identified as the main sector for efficiency improvement measures, with a reduction in energy consumption of approximately 5.7 Mtoe compared with the base scenario for 2030 and a commitment to gradually eliminate oil for heating purposes. In particular, the residential sector contributes to 3.3 Mtoe of this decrease, whereas the tertiary sector reduces the projections for its consumption by 2.4 Mtoe, thanks to structural renovation measures and the installation of heat pumps, as well as a greatly improved efficiency of end-use devices. In this regard, it is useful to monitor best practices that can easily be replicated on a local level, especially in integrating RES in the construction sector. Lastly, simplifying authorisation procedures and removing or relaxing town planning constraints, which are particularly strict for certain installations, could help develop the use of RES on a more broadly agreed and widespread manner. In this, the public

administration would need to assume more responsibility for promoting decarbonisation in public sector building projects.

A further significant contribution is made by the transport sector, which, as a result of measures to shift private passenger mobility towards collective and/or smart mobility and freight transport from road to rail, and the improved efficiency of vehicles, is responsible for an approximately 2.6 Mtoe contribution to the gap between the two scenarios for 2030. The industrial sector should achieve a reduction in consumption of approximately 1.0 Mtoe, but this does not mean it is a sector with few opportunities for action.

Thanks to the use of technological models of the entire energy system, there is no need to employ predetermined conversion factors, with the quantification in primary energy instead being accounted for directly by modelling tools.

(3) the indicative milestones of the long-term strategy for the renovation of the national stock of residential and non-residential buildings, both public and private, the roadmap with domestically established measurable progress indicators, an evidence-based estimate of expected energy savings and wider benefits, and the contributions to the Union's energy efficiency targets pursuant to Directive 2012/27/EU in accordance with Article 2(1) of Directive 2010/31/EU;

Some preliminary figures inferred from the strategy currently being drawn up are set out below.

Table 16 shows a breakdown of Italy by climatic zone and the respective number of municipalities.

Table 16 Number of Italian municipalities by climatic zone and 'degree days' (produced by ENEA using ISTAT data)

Climatic zone	Degree days (DD)	Number of municipalities at 1/1/2019	Resident population, 2018	% resident population
A	GG<600	2	23,266	0.04%
B	600 <GG < 900	157	3,217,288	5.33%
C	900 <GG < 1,400	981	12,826,700	21.25%
D	1,400 <GG < 2,100	1,572	15,168,668	25.13%
E	2,100 <GG < 3,000	4,176	27,482,108	45.53%
F	GG>3,000	1,026	1,641,892	2.72%

For winter heating of existing buildings, national energy consumption can be deemed proportionate to the product of degree days and population. Thus, climatic zone E, which has the highest population, accounts for the largest share of consumption, while climatic zone B has the lowest share, excluding zone A, in which just 0.04% of the population lives (it consists of just two municipalities).

The consumption structure for final uses in 2017 shows the high proportion of civil uses, at 45% of total final consumption, a rise of 7.4% on 2016. Of this 45%, the residential sector accounts for 29% of the total and services (the sector that experienced the highest growth), for 16%.

Size of the national stock of buildings

Residential buildings

Italy has 12.42 million buildings intended for residential use, with nearly 32 million homes. Over 60% of this stock is over 45 years old; in other words it was built before Law 373/19763, the first energy-saving law, came into force. Of these buildings, over 25% have annual consumption ranging from a minimum of 160 kWh/m² per year to over 220 kWh/m². The situation of the building stock in the residential sector is illustrated below, broken down by year of construction and climatic zone, and by state and condition of the buildings.

Table 17 – Residential buildings, number and floor area 2018, by period of construction

Period of construction	Number of buildings	m ²
<1919	1,832,503	824,318,007
19-45	1,327,007	596,929,863
46-60	1,700,834	765,089,112
61-70	2,050,830	922,528,420
71-80	2,117,649	952,585,727
81-90	1,462,766	657,998,570
91-2000	871,017	391,811,090
2001-2005	465,092	209,213,142
2006-2011	359,991	161,935,377
2011-2018	232,714	104,682,143
Total	12,420,403	5,587,091,450

Table 18 – Residential buildings, number and floor area 2018, by climatic zone

Climatic zone	Number of buildings	m ²
zone A	5,217	2,327,200
zone B	710,079	298,025,940
zone C	2,737,222	1,127,236,450
zone D	2,896,204	1,355,373,650
zone E	5,340,672	2,535,572,770
zone F	731,009	268,555,440
Total	12,420,403	5,587,091,450

³ Provisions to limit energy consumption for heating purposes in buildings.

Non-residential buildings

Buildings intended for non-residential purposes are grouped in the most common categories: schools, offices, shopping centres, hotels, health-sector facilities.

There are about 435,000 non-residential buildings on Italian territory intended for these purposes, excluding health, as shown in the table below. The total floor area is about 340 million square metres, of which 37% in climatic zone E, and, overall, nearly 70% in temperate or cold zones.

Table 19 – Non-residential buildings (schools, offices, shopping centres, hotels) and area by climatic zone

Climatic zone	Number of non-residential buildings	m ²
zone A	148	173,490
zone B	22,515	23,421,687
zone C	84,233	83,915,666
zone D	102,264	95,050,723
zone E	206,451	125,487,887
zone F	19,119	13,231,516
Total	434,730	341,280,969

More details and analyses will be included in the long-term strategy for the refurbishment of the building stock, which is expected to be ready by 10 March 2020.

In the case of hospital buildings, the National Health Service's statistical yearbook shows that in 2016 Italy had over 27,000 public and accredited private sector health facilities, broken down by type as shown in the table below.

Table 20 – Number of facilities by type of healthcare provided, 2016

Healthcare type	Type of facility		Total
	Public	Private accredited	
Hospital care	537	492	1,029
Specialist outpatient care	3,628	5,300	8,928
Local residential care	1,326	5,998	7,324
Local semi-residential care	974	2,090	3,064
Other local care	4,932	717	5,649
Rehabilitation (under Article 26)	246	863	1,109
Total	11,643	15,460	27,103

Nearly zero-energy buildings

Lastly, all of Italy's Regions are experiencing an increase in nearly zero-energy buildings (nZEBs), of which there were about 1,400 in 2018. Most of these were newbuilds (90%) and for residential use (85%), as noted by the 'nZEB Observatory'. The refurbishment of over 130 mainly non-residential public buildings to nZEB standard is planned by the end of 2020.⁴

⁴ ENEA, Costanzo E., Basili R, Hugony F., Misceo M., Pallottelli R., Zanghirella F., Labia N., 2019. "Osservatorio degli edifici a energia quasi zero (nZEB) in Italia 2016-2018".

However, nZEB buildings account for no more than 0.03% of existing stock on a regional basis, while less than 10% of all nZEBs are existing buildings – mainly schools and small single or two-household homes – that have been refurbished to meet these standards.

Assessment of consumption

The average consumption for the various intended uses was calculated with reference to the distribution of buildings by climatic zone and period of construction, and on the basis of the consumption data resulting from statistical surveys on a representative set of buildings. The results of some initial analyses, which may be updated in the final strategy, are shown below.

Table 21 – Intended use and average annual consumption indicator weighted by climatic zone

Intended use	Electricity consumption (kWh/m ² /year)	Heating/cooling consumption (kWh/m ² /year)	Total consumption (kWh/m ² /year)
Single-family households	21	124	145
Multi-family households	21	123	144
Schools	17	89	106
Offices	111	45	156
Hotels	110	150	260
Commercial			448
Public administration	55	143	198
Hospitals	253	385	638

Table 22 – Specific consumption, buildings for office use, from ENEA diagnoses

Geographical region	Electricity consumption (kWh/m ² /year)	Heating/cooling consumption (kWh/m ² /year)	Total consumption (kWh/m ² /year)
Northern	155	102	257
Central	109	59	168
Southern	116	19	135

As regards buildings for large-scale retail distribution, electricity is the most widely used form of delivery for final energy use, at over 90%, as shown by studies conducted at both the Italian and European levels. The study conducted on energy diagnoses for the food sector found an average of nearly 95%, taking energy withdrawn from the grid, self-produced and self-consumed. The following table shows the average specific consumption for the various types of large-scale distribution; the values for supermarkets and hypermarkets are again taken from the energy diagnosis study.

Table 23 – Specific consumption commercial buildings, from ENEA diagnoses

Type	Total consumption
Minimarket	535
Supermarket	598
Hypermarkets	527
Department store	255
Specialist large-scale	219

In the case of hospital facilities, the figures shown in Table 18 can be updated with reference to the specific average consumption figures obtained by ENEA in a study on mandatory energy diagnoses. This study found average electricity consumption of 303 kWh/m² and consumption for heating and cooling of 342 kWh/m².

Estimated refurbishment rate

To provide further observations on the results of the models used in the simulation underlying the INECP, this section on the long-term strategy for the refurbishment of Italy's building stock examines the current refurbishment rate that is needed to reach the targets, as though each renovation initiative were deep, i.e. envisaging large-scale renovation work both on the buildings themselves and on the installations (**virtual deep renovation rate (VDRR)**). This necessarily produces lower rates than those on which the INECP models are based, but it allows for the normalisation of the types of intervention and the specific savings related to them.

Current refurbishment rate

The **VDRR** of Italy's building stock can be estimated with reference to different types of intervention and technological solution, starting with the data relating to tax deductions for energy efficiency initiatives (known as the 'Ecobonus'). Ecobonus estimates indicate that in 2014-2018 over 1.7 million projects were carried out, of which more than 334,000 in 2018. Of these, about 140,000 applications were for replacement window and/or door frames, 90,000 for replacement winter heating systems and over 70,000 for solar shading systems. Door and/or window replacements accounted for 33% of the savings obtained in 2018 and the insulation of under-roof spaces and vertical closures for 28%, with other savings from work on winter heating systems.

The annual **VDRR** for Italy's building stock, estimated using the average energy saving in kWh/m² achieved in 2014-2018 through initiatives related to paragraph 333 of the Ecobonus provision (overall refurbishment), is about 0.26%.

Focus on 2030 and 2050

To analyse the **VDRR** to 2030 a specific modelling tool was developed.

The initial annual **VDRR** estimates for the residential sector for 2020-2030, which are necessary to obtain the 2030 INECP target, point to a need to accelerate the **annual VDRR to around 0.7%**.

From a technological perspective the analyses are consistent with the INECP's trend of strong growth in air-water heating pumps to be used for domestic hot water (DHW), heating and cooling systems, both autonomous and centralised. By 2030, in the light of the goal of almost

complete decarbonisation by 2050, a growth in the rate of transforming existing buildings into nZEBs can already be assumed.

For **non-residential buildings**, on the other hand, a cost-optimal model (i.e. which considers only those interventions that have the minimum cost for the best result) was developed. This gave a **VDRR of 2.9% by 2030** (hospitals excluded).

By 2050 the target scenario envisaged by the long-term strategy referred to in the Governance Regulation envisages almost complete decarbonisation in the civil sector, with the elimination of direct emissions in the residential and services sectors. To achieve this goal, a start can be made from the INECP target scenario for 2030, with appropriate interventions in the civil sector.

For both the residential and non-residential sectors it will therefore be necessary from 2030 to 2050 to make a further effort to reduce final energy consumption and CO₂ emissions with respect to the **VDRR**.

(4) the total floor area to be renovated or equivalent annual energy savings to be achieved from 2021 to 2030 under Article 5 of Directive 2012/27/EU on the exemplary role of public bodies' buildings;

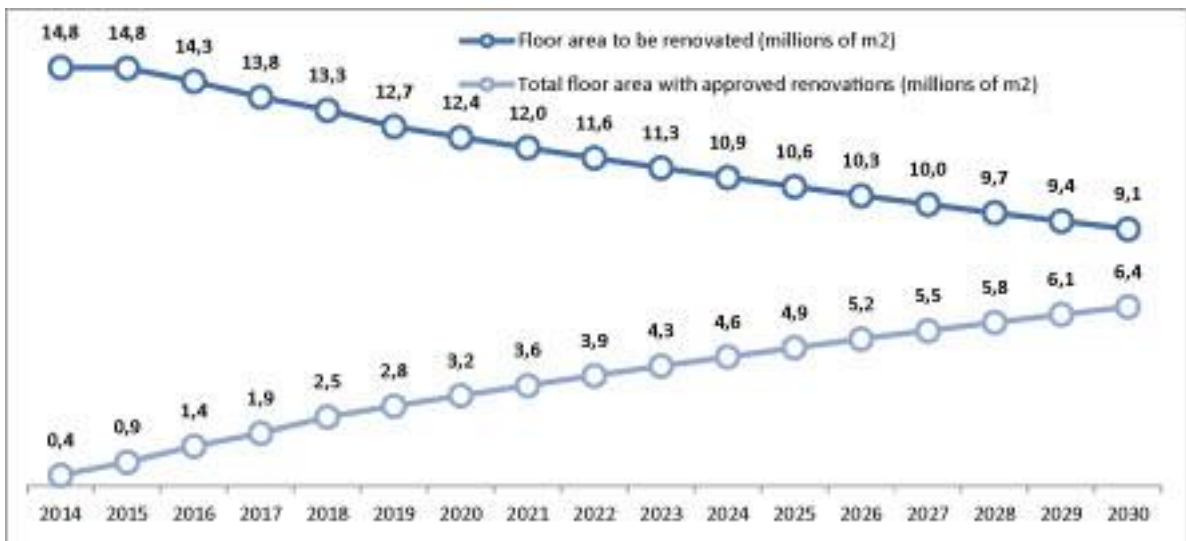
With regard to the energy renovation each year of 3% of the floor area of properties of the central public administration pursuant to Article 5 of the EED, the current programme of measures is expected to be able to meet the obligation imposed by the Directive.

The existing measure was also reinforced by the 2019 Budget Law, which earmarked further resources for the programme, totalling €25 million for 2019 and €40 million each year from 2020 to 2022.

Provision is also made to continue with the Energy Renovation Programme for the Central Public Administration (PREPAC) during the period 2021-2030, which programme will be enhanced as a result of the experience gained during the seven-year period 2014-2020.

In particular, considering an overall floor area of buildings subject to the provisions of Article 5 of the EED equal to 15.2 million m² in Italy per 4 102 occupants, during the period 2021-2030, 3.2 million m² of floor area of buildings associated with the central public administration will be subjected to energy renovation.

The following figure shows the trend in floor area in respect of which renovation has been planned and financed, and the floor area which is still to be renovated. The data from 2014, i.e. starting from the year the obligation was imposed, to 2018 are final, whereas the data for the following years up until 2030 are assumed to comply with the minimum rate of 3% established by the EED.

Figure 19 – Trend in renovations of the building stock of the central public administration (millions of m²)


ii. *The indicative milestones for 2030, 2040 and 2050, the domestically established progress indicators, a reliable estimate of expected energy savings and wider benefits, and their contributions to the Union's energy efficiency targets as included in the roadmaps set out in the long-term renovation strategies for the national stock of residential and non-residential buildings, both public and private, in accordance with Article 2(1) of Directive 2010/31/EU*

Reference is made to the information given in section i.(3) above

iii. *Where applicable, other national objectives, including long-term targets or strategies and sectoral targets, and national objectives in areas such as energy efficiency in the transport sector and with regard to heating and cooling*

The attainment of the energy targets, as previously described, is strategically linked to the renewal of the building stock, both public and private, with priority being given to energy efficiency and the use of renewable energies.

In order to attain the targets, technologies capable of ensuring low heating, cooling and domestic hot water (DHW) demand, which will be met with high energy efficiency and the use of renewable sources, must be used. Consideration must also be given to the increase in comfort demand in households, associated, in particular, with the relatively new cooling demand.

Heat pumps, both electric and gas, which allow heating, air conditioning and DHW production to be carried out using just one item of equipment, clearly making them suitable for providing air conditioning to a significant number of civil buildings located in Italy, are of strategic importance amongst the solutions that are currently available.

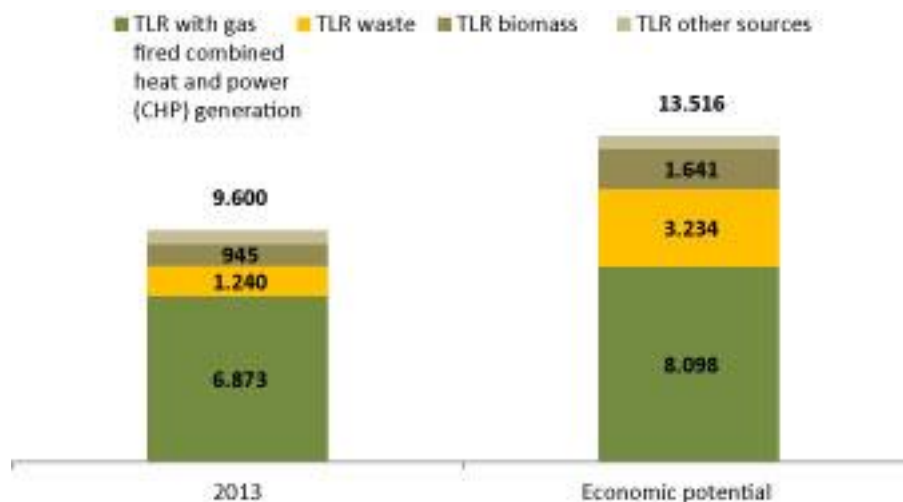
In addition, Italy will aim to expand the use of efficient district heating and district cooling by exploiting the residual economic potential in a manner consistent with the other objectives of energy and environmental policy, including the reduced demand for energy recovery from waste and the limited use of biomass in order to reduce emissions.

In particular, according to the results of the report drafted by GSE on the assessment of the national potential for the application of HEC and efficient district heating established by Article 14 of the EED, the economically sustainable growth potential for energy provided by district heating is approximately 4,000 GWh, to be attained by extending national district heating and district cooling networks by approximately 900 km, on top of the current network size of approximately 4 100 km.

A review of this potential is planned in the near future as part of the update envisaged by the EED.

The above-mentioned GSE report estimates an incremental economic potential of HEC in the industrial and service sectors of about 14 TWh for heat and 10 TWh for electricity. In this respect, possible synergies between the promotion of energy efficiency and the use of heating/cooling renewables, and the benefits of electricity-thermal coupling that could be produced by fuelling HEC systems using biomethane will need to be evaluated.

Figure 20 – Economic potential of growth in energy provided by district heating (TLR) by source (GWh) [Source: GSE, 2015-2016 Report on the assessment of the national potential for the application of high-efficiency cogeneration (HEC) and efficient district heating (TLR)]



The aforementioned assessment of the growth potential for district heating was conducted jointly with the assessment of the growth potential for high-efficiency cogeneration, with focus being placed, as a matter of priority, on the main sources for each objective (district heating and HEC), namely natural gas, biomass and waste. It may be appropriate to carry out an in-depth and broad spectrum analysis on the integration into district heating networks of certain technologies that are currently marginal in a district heating context, but have potential for high-density urban neighbourhoods, such as, for example, thermal solar energy, centralised heat pumps or the recovery of waste heat from installations located throughout Italy. The assessment of the potential of district heating and HEC, and the integration of these technologies, will be updated and examined more closely with a view to 2030 (according to the provisions of Article 15 of RED II), with account being taken of a new generation of district heating systems that are ready for use (fourth generation), characterised by a low temperature of the heat transfer fluid, and of the role that could be played by heating storage combined with solar installations, HEC systems and district heating networks.

2.3 Dimension energy security

In addition to discussing the security of gas supply from third countries, this section will also cover the security of the electricity system, insofar as a discussion of the security of the overall energy system must also give consideration to the security of supply to consumers, as well as certain aspects specific to Italy: on the one hand, the two systems are strongly interdependent, and will only become more interdependent in the future, as electricity production is primarily ensured by renewable sources and gas, with a minor contribution from coal; on the other hand, as mentioned previously, the government plans to phase-out the use of coal for electricity production by 2025.

Security of energy supply will be ensured by diversifying the LNG supply routes and above all by reducing energy imports, as a result of the strong development of renewable sources and increased energy efficiency.

i. The elements set out in Article 4(c)

National targets:

- 1. increasing the diversification of energy sources and supply thereof from third countries, with a view to reducing energy import dependency,*
- 2. increasing the flexibility of the national energy system;*
- 3. addressing constrained or interrupted supply of an energy source, for the purpose of improving the resilience of regional and national energy systems, including a timeframe for when the objectives should be met;*

Gas sector

From the scenarios considered, a demand of 49 Mtoe of natural gas (approximately 60 GSm³) is projected for 2030, with a peak for inland consumption in 2025 caused by the elimination of coal from the electricity generation mix. To this should be added the volume of biomethane intended for the transport sector, currently quantified at approximately 1 GSm³ under the current system of obligations on biofuels, but which could make a further contribution as a source of renewable gas in all final uses, including electricity generation. The gas system will thus be of vital importance for the national energy system, with the potential to become the centrepiece of the 'hybrid' electric-gas energy system, including in light of the development of renewable gas (biomethane, hydrogen and synthetic methane) and the drive to boost the use of alternative fuels in the transport sector. This central role of gas in the energy system will be ensured without developing new major infrastructure, apart from that already being built or currently planned.

The Italian gas system, which is geographically 'downstream' of the more important natural gas pipelines that currently cross Europe (Russian gas and North Sea gas), is well known to have gas trade prices higher than those at the main European hubs. The reason for this spread is that the Italian market is still not fully integrated with the more liquid markets in northern Europe, to which it is connected through the Swiss Transitgas pipeline, the short-term transport capacity management of which is non-compliant with European rules, meaning that shippers are unable to balance the prices between the two markets daily. This situation has now deteriorated considerably as a result of the closure of one of the two gas pipelines

making up the TENP transport system in Germany, which connects the Swiss Transitgas pipeline to northern Europe.

Under normal circumstances, this would only result in a higher energy cost in Italy, but, under particular cyclical conditions, there is a risk that the system may experience a supply crisis. With regard to supply standards, therefore, recent analyses carried out by the Ministry of Economic Development following changes to the general framework last winter (2017/2018) have highlighted a number of critical issues in terms of meeting demand in the scenarios identified by the Regulation itself.

When evaluating infrastructural measures, Regulation (EU) 2017/1938 imposed the obligation on Member States to adopt the necessary measures to meet the maximum daily gas demand, even if the flow from the main gas supply infrastructure for the country, namely the infrastructure with the highest supply capacity according to what is known as the 'N – 1 formula' (for Italy, the pipeline for imported Russian gas), is completely interrupted.

The results of the N – 1 formula in the most recent risk analysis document submitted by Italy to the European Commission in 2017 contain a value that is very close to the minimum threshold below which the infrastructural standard of the country is deemed inadequate to ensure the necessary levels of security for the country. This result is caused by both the increase in peak gas demand recorded over the last few years and, above all, the decrease in flows, already recorded or legitimately foreseeable, from certain important import gas pipelines in operation, caused by technical issues linked to the functionality of the gas pipeline and the decrease in volumes of import contracts being renegotiated with Algeria.

The most detailed current simulations, relating to what might happen in the event of the main source of supply being interrupted in coming winters, highlight risks for the system, which, in certain scenarios, might be unable to meet gas demand for connected users.

The results of the simulations show a less than optimum supply situation for natural gas in Italy in the event of periods of crisis that might occur in coming winters, a situation that will be brought back in line with the minimum threshold value by optimising entry flows.

In the gas sector, the main objective is to ensure that the overall system is more secure, flexible and resilient and able to deal with a market situation that is, by nature, increasingly uncertain and volatile, as well as supporting the robust development of non-programmable renewable sources, by ensuring that energy demand is met, above all in relation to peaks in demand that coincide with low production levels from renewable sources.

These objectives may be achieved by:

- increasing the diversification of sources of supply, by optimising the use of existing infrastructure and developing the LNG market and increasing the growing share of renewable gas (biomethane, synthetic methane and, eventually, hydrogen) in the network;
- improving the flexibility of the national system with respect to sources of supply by means of updating the gas transport network, including for the purpose of increasing its security and control standards, in accordance with the provisions of the 10-year development plans for transport companies;
- improving the security margin in the event of large peaks in demand;
- coordinating the national emergency plans with those of the other countries along the same physical supply corridors, as provided for by European Regulation 2017/1938 on the

security of the gas system, by additionally establishing possible solidarity measures between Member States.

Oil products sector

Although oil products are characterised by decreasing demand towards 2030, they still represent 31% of total domestic energy demand, particularly in the transport and petrochemical sectors. On the path towards economic models for development based on renewable sources, it is noted that even the refining sector may make a positive contribution to the transition towards an economy with a smaller carbon footprint, given a high degree of specialisation, cutting-edge production processes and a continuous, strong commitment in terms of research and development.

Oil products still constitute a raw material, even for what is known as green chemistry, as well as for the production of plastics, synthetic rubbers and fibres, detergents and other mass consumer goods. Over the last few years, oil products have met approximately 90% of the demand for raw petrochemical materials, followed by gas and solids, to a negligible extent. The most important supplies from foreign countries are oil and refined products. The majority of the supplies originate from countries with high geopolitical risk profiles; in order to counteract this unfavourable situation, a significant diversification of suppliers was initially established (Algeria, Libya, Iran, Russia) and continues today (for example Azerbaijan, Qatar, the USA, Canada). The issue surrounding the dependency on some of these supplies, in particular with regard to aviation fuels, which might be susceptible to price pressures, still remains.

According to the methodology of the International Energy Agency, Italian stocks of crude oil and oil products in 2018 amount to 130 days of imports, corresponding to 90 days of net imports according to current European legislation. Italy has developed an efficient stock system, the management of which is entrusted to the Single Buyer (OCSIT), operating under the supervision of the Ministry of Economic Development, with the obligation to acquire the equivalent of 30 days of security stocks, on behalf of the State, by 2022. OCSIT, which operates on a not-for-profit basis with costs being borne by oil companies on the basis of their in-purchase for consumption to the national market, operates by buying, selling and maintaining stocks of the main oil products in Italy. Since it commenced operations in 2014, OCSIT has acquired, through public procurement procedures, the equivalent of 12 days of stocks, and will continue its operations by accelerating the timeframe for acquiring stocks in order to profit from the current low price level for oil products.

The refining crisis in Italy has resulted in the reconversion of five important refineries: Mantua, Rome and Cremona have been reconverted into logistics centres, whereas Marghera has been reconverted into a biorefinery and Gela is nearing the conclusion of its reconversion process, with a view to the production of advanced biofuels, a sector where Italy boasts a significant technological leadership position.

Electricity sector

The national objectives in the context of energy security for the electricity sector are broken down into infrastructure objectives, which aim to increase the security of supply in various projected situations, in line with the ENTSO-E scenarios and with the projections of the TSO, and management/organisational objectives, which aim to bring about the necessary legislation allowing the barriers and restrictions that hinder the implementation of the

aforementioned measures to be eliminated, and in order to target investments towards the general objectives of the Plan, in accordance with cost/benefit efficiency criteria.

The development of interconnections with other networks and solutions designed to create synergies with the gas sector (sector coupling), in a context involving far-reaching changes to the European market, addresses the need to better tackle the issues of system reliability in terms of suitability and flexibility, as well as the need to widen the dimension of the market itself and reduce the price gap.

Today, Italy's interconnection capacity is primarily concentrated on the north-west and north-east borders of the country, complemented by additional connections with Greece and, since November 2019, with Montenegro.

The interconnections along these borders will be further enhanced (cf. section 2.4.1) in order to contribute towards the attainment of the targets identified by the Energy Union, in line with a cost-benefit approach and with priority being given to connections with systems having highly developed renewable energies and/or able to contribute towards reducing domestic prices. The development of network projects is provided for in the TSO's development plans as approved by the Ministry of Economic Development, subject to the opinion of the regulator, which is conducting a public consultation, and submitted for the strategic environmental assessment (SEA) procedure.

Internally, the new generation system will be characterised by strong growth in non-programmable and small-scale renewables, with increasing network management complexity and a similarly increasing demand for flexibility for balancing purposes. Even considering the possibility that infrastructural assets and the very design of the market may change over time, today the scenarios for strong growth of renewable production are technically sustainable in conditions of security, provided that the works to develop the network identified in Terna's plans (new electricity lines and upgrading of pre-existing line sections) are carried out in parallel, in order to manage the effects resulting from changes to the production mix, including the process for the phase-out of coal, and to increase cross-zonal transport capacity. According to technical analyses, in addition to the works already planned, the issue of congestion requires further development of the transmission network for a 1000 MW increase along the Adriatic coast.

The creation of a vast storage capacity, and storage solutions that envisage the use of alternative forms of energy (hydrogen/synthetic methane), both concentrated on network service and distributed, is just as vital in order to offset certain critical issues and to make sufficient flexibilities available.

A key objective will be to maintain appropriate system conditions, including in the mid-long term, and above all in a scenario involving significant changes to the domestic and European generation mix and to the array of potential (demand response; storage technologies) and available resources; this objective calls for appropriate intervention mechanisms, primarily identified, at this stage, to be the new mechanism for remunerating capacity. In addition, the measures aimed at ensuring the widest possible participation in the services market of all resources that may contribute towards security are pursuing the same objectives.

With a time scale fixed for 2030, a series of objectives, as described below, should be identified for each area of intervention. A summary of the objectives, as well as the quantitative aspects thereof, will be provided at the end of the section, in order that each

objective may be linked to the detailed measures associated therewith, as described in section 3.3.

ii. National objectives with regard to increasing the diversification of sources and associated supply from third countries for the purpose of increasing the resilience of regional and national energy systems

Gas sector

In consideration of the fact that gas will continue to perform an essential function for industrial and domestic uses (in addition to transport) and, above all, for electricity generation in the short-mid term, in conjunction with renewable sources, particular focus will still be placed on diversifying the sources of supply.

The majority of gas supplies currently originates from countries with high geopolitical risk profiles; in order to counteract this unfavourable situation, attempts have already been undergoing for a number of years to diversify non-European suppliers (Algeria, Libya, Qatar, Russia), and attempts are still actively being made in this respect (e.g. Azerbaijan, and the USA and Canada for LNG).

With regard to the objective of diversifying import capacity, work is in progress on the following aspects:

- optimising the use of LNG import capacity in existing terminals, maintaining the capacity of which will continue to play a strategic role, to promote Italy's participation in the Mediterranean and global LNG market, in competition with terminals in northern Europe;
- opening up the southern corridor by way of the TAP (Trans Adriatic Pipeline), which will be operational in a very short timeframe (by 2020), enabling the import of approximately 8.8 billion m³ of Azerbaijani gas per year to Italy, with a potential growth in capacity of more than 10 billion m³ per year, which can be achieved without the need for any new infrastructural measures on its Italian section, for which the capacity bidding process for phase 2 is under way;
- EastMed project: although the project will allow further diversification of the current routes from 2025 onwards (throughout the EU, Italy is the country with the greatest diversification of its sources), it might not be a priority, given that the decarbonisation scenarios may be achieved through pre-existing infrastructure and the aforementioned TAP.

Encouraging the production of renewable gas to inject to the network and, in future, to adopt for all final uses, including electricity generation, also seems useful.

Electricity sector

The main objective is to implement new market instruments, in order to channel investments towards new storage systems and generation capacity and to promote (as in the case of the market for network services) a progressively more active role for demand and other resources that can support adequacy, on the basis of pre-established standards. This will be achieved through the new capacity market, launched in late 2019, by emphasising technologically advanced solutions having a low environmental impact, in line with the general objectives of the Plan in terms of decarbonisation, and through the requirements arising from the penetration of non-programmable renewables. In this context, and in line with the positions that emerged from the public consultation, the possibility for the operators of small installations operating as groups to participate in non-programmable RES balancing services will also be assessed. In an electrical system fed by an energy mix where the renewable energy share is projected to grow considerably, the generating costs structure will tend to tip over towards fixed costs, including for conventional installations required to work for less hours per year compared with the design standards. Therefore, market mechanisms based on capacity, which are indispensable in terms of security and adequacy, may even have positive effects on network services costs and wholesale prices in the mid-long term.

In this respect, it should also be mentioned that, amongst the various coordinated actions carried out by European countries, provision is also made for a different approach to the issues of adequacy and security, which is no longer solely delegated to individual states, but is to be assessed as a whole, without prejudice to the responsibilities of individual countries. In this respect, Regulation (EC) No 714/2009, recently amended with the adoption of Regulation 2019/943 of 5 June 2019 (the Electricity Regulation), establishes that it is up to the ENTSO for Electricity to draft general adequacy and security scenarios (half-yearly and mid-term outlooks), with the individual operators of each country thus being tasked with working out the details and specifics of each system. In the most recent mid-term adequacy outlook (mid-term adequacy forecast – 2019), the ENTSO for Electricity highlighted critical issues for Italy as early as in the short-term (2021) in specific areas (Sicily) and, even more seriously, in the mid-term (2025) throughout the central north of Italy and the larger islands. This is not a new phenomenon, insofar as Italy has for a number of years now experienced a decrease in the operational reserve margin, particularly in the central north of the country, as a result of reduced thermoelectric capacity in periods of particular stress (typically peaks in consumption during the summer and winter, coinciding with problems resulting from the unavailability of installations in interconnected countries, and resulting reductions in the external balance). The analyses carried out by Terna and included in the adequacy report, highlighted that, in an inertia scenario, and certainly by 2025, the thresholds of the two indexes, LOLE (Loss of Load Expectations, which represents the number of hours per year in which demand exceeds available resources, including imports) and ENS (Expected Energy Not Served, which represents the surplus demand with respect to available resources, measured in terms of energy), would not be met. As regards this last topic, the Italian Government has set the LOLE value as 3h/year.

In consideration of the above, the Italian government – just like the governments of many other European countries – deemed it necessary to equip the system with instruments able to ensure, in the mid-long term, the availability of the necessary capacity to meet the adequacy requirements of the Italian electrical system. At the same time, they should promote the development of new efficient and environmentally sustainable capacity. To this end, the rules governing the capacity market have been integrated with the projected emissions limits for CO₂ per unit of energy delivered to promote, as of now, installations having a low environmental impact (in addition to active demand and renewables), excluding

coal-fired installations. In so doing, Italy has anticipated the provisions of Regulation (EU) 943/2019 and ensured that the new instrument serves the transition towards the decarbonisation objectives for electricity production. The system was launched with the auctions for 2022 and 2023.

The consolidation of the system with regard to adequacy through mechanisms to remunerate capacity will result in a different cost structure for the system, with a cost for remunerating power that will be balanced, in terms of benefits, by limitations on supply for those installations and resources that adhere to the new system and, therefore, by the calming effect on prices on the energy and services markets; there will also be significant benefits in terms of increased security, in respect of which the strengthening of the reserve margins may gradually reduce the need to implement extraordinary measures in the event of seasonal emergencies, including improvements in terms of interruptibility and the replacement tertiary reserve.

A further objective concerns the major development of storage capacity, which will be gradually but increasingly targeted towards 'energy-intensive' solutions, in order to limit the phenomenon of over-generation and to promote the attainment of renewable energy consumption targets. Nowadays, hydroelectric storage systems represent the most mature option of the various storage technologies. The significant penetration of renewables will require, first and foremost, an increased use of pre-existing pumping systems, thanks to planned network upgrades in the north of Italy, in addition to new systems in the same category. Pumping systems are an important resource for adequacy, as well as for the security and flexibility of the system, as they are able to provide maximum available capacity in periods of higher load, which is ensured through the filling of upstream reservoirs as a result of the pumping schedule for these systems in periods of lower load. In addition, over the next few years, it will also be necessary to pursue considerable development of electrochemical storage, both distributed and centralised, guided by a cost reduction curve that will increase the profitability of distributed photovoltaic generation systems with batteries.

Finally, the objective towards an increased resilience of the electrical system will be pursued through actions aimed at reinforcing control systems and networks, by optimising coordination mechanisms between the various competent institutional bodies; this objective will concern improvements to the prevention capacity, the development of the system's resilience to periods of stress, the efficacy of emergency response and restoration of service in the event of outages, and the guarantee of safety for all subjects variously involved. The objectives in this regard must necessarily give all due consideration to the transnational aspect of security risks, in light of the growing interconnection of transmission networks, and the resulting need for increased coordination between European countries, including in terms of defining the national plans.

With regard to the security of the electrical system, a national technical forum was set up between ARERA, TSO and DSOs in order to identify the measures needed to increase the resilience of electrical infrastructure in the face of increasingly frequent extreme weather events, which lead to extended service outages throughout the whole of Italy. Providing specific guidelines, the Ministry of Economic Development decided that the authorised distributors and Terna should all submit resilience plans, indicating the areas and lines most at risk, the phenomena that may compromise service, and the measures to avoid or, in any case, reduce the probability and extent of outages. Network operators must also indicate measures, including in coordination with other institutional stakeholders, including the

Department of Civil Protection, local authorities and prefectures, for restoring service if disruptions occur in conjunction with the event.

By Resolution No 668/2018/R/eel of 18 December 2018, ARERA identified a system of rewards and penalties to incentivise resilience measures.

iii. Where applicable, national objectives with regard to reducing energy import dependency from third countries, for the purpose of increasing the resilience of regional and national energy systems

The objective of increasing energy independence will be pursued primarily through an increased production of renewable energy and energy efficiency, in a manner that will be clarified in the relevant chapters. On the basis of the scenario with targets, energy dependence should decrease from 77.7% in 2016 to approximately 68% in 2030. The resilience of the overall energy system will also be enhanced by ensuring a greater degree of integration of electricity interconnections with other countries (see relevant chapter) and diversifying the sources of supply.

iv. national objectives with regard to increasing the flexibility of the national energy system, in particular by means of developing domestic energy sources, demand response and storage

The objectives on renewable sources will be pursued primarily through the development of domestic resources, albeit within the framework of exchange with other countries.

The use of demand response and storage facilities in order to improve the flexibility and security of the system (electrical, and, as a result, also gas) is already in the start-up phase. In particular, in applying the principles of law, ARERA defined the criteria by which demand, unauthorised production units (including those powered by non-programmable renewable sources and distributed generation), and storage systems, including electric car batteries, may participate in the dispatching services market. Therefore, pilot projects allowing figures referred to as aggregators to participate in the market by aggregating consumption units, non-relevant production units and relevant production units not yet authorised to participate in the services market, including in mixed configurations (UVAM: authorised mixed virtual units), were launched. Once the trial currently in progress has concluded, these modes of participation in the market will be integrated into the regulatory framework. In this regard, the ARERA is currently reviewing the overall regulatory framework for dispatching, not least in the light of the new EU provisions. The aim is to promote a reorganisation of the ancillary services market and the rules governing imbalances, in such a way as to increase market efficiency; ensure the fullest possible participation of all available resources, with due regard for security constraints; and limit system costs.

Storage facilities will have particular relevance, not just in terms of security and flexibility, but also in order to keep over-generation to a minimum. In this respect, on the basis of the analyses on the scenario with targets and in consideration of the target trajectories for renewables, in addition to an optimum management of pre-existing water storage systems, it is estimated that new storage systems for almost 1,000 MW in production, split between hydroelectric and electrochemical production, will be necessary as early as in the mid-term (around 2023). Preliminary estimates for 2030 indicate that approximately 6,000 MW, split

between pumping and centralised electrochemical production, in addition to distributed storage facilities (corresponding to about 4,000 MW), will be required, which will also help limit over-generation from renewables to around 1 TWh. To this end, a study was launched to identify sites suitable for new pumping systems based on pre-existing river basins or lakes.

Moreover, these estimates assume the implementation not only of measures for expanding the resources that contribute to the services market, but also works to enhance and upgrade the electrical transmission and distribution network, including both increased meshing, partly with a view towards smart grids, and the installation of apparatus designed to optimally manage energy flows.

In this respect, the network measures and new storage capacity must be programmed in coordination with the measures for developing renewables. The aim is to encourage the siting of installations on the basis of criteria that take into account the availability of resources, suitable sites, and economic constraints and feasibility. A key consideration here is the increased capacity of the system to change energy availability timeframes, as envisaged by the recently approved Electricity Market Regulation and Directive.

In parallel to this, and in consideration of new EU regulations, effective ways of attracting private investments, not just in terms of generation, but also storage facilities, will be identified. Storage solutions envisaging the use of alternative means of delivering energy (e.g. hydrogen) could also be assessed.

Although not an objective in itself, it is worth mentioning that the authorisation procedures relating to the performance of works connected to the above points will be simplified and expedited, with the reference legislation also being updated, if necessary. It will be important, for example, to simplify the authorisation procedures for pumping systems, including for small distributed installations.

Alongside pumping and electrochemical storage, the intention is to promote the development of other technologies that enable energy to be stored and/or integrated with other forms. Of these, the various forms of power-to-gas could play a key role, as emerged, for example, from the INECP consultation process. Hydrogen synthesis from excess renewable electricity could be particularly interesting, to be used for storage or injected into the gas network, subject where appropriate to methanisation. An assessment will be made of whether pilot projects to test the functionality, cost-effectiveness and replicability of the various technological solutions should be carried out. The potential of technologies that enable storage in the form of thermal energy, especially HEC and district heating systems, will also be assessed.

In summary, the objectives for the energy security of the electrical system and associated measurements are as follows.

- Increased resilience and flexibility of the system, by prioritising the use of technologically advanced solutions for managing and controlling network parameters (frequency, voltage, short-circuit capacity), so as to combine the attainment of the objectives set in the network development plans and the system defence plans with those deriving from the present Plan.
- Implementation of capacity market mechanisms, already adopted, to ensure the adequacy of the system in a manner coherent with the decarbonisation targets and with the targets set for the development of renewables and energy efficiency. To this

end, emissions limits on the CO₂ produced have been established; these allow only those installations having a low environmental impact to participate in the capacity market.

- For existing pumping systems, expected increased hours of use with respect to current levels of 90% for systems located in northern Italy and of 80% for those located in the south (equating, for both, to over 600 storage hour equivalents).
- Installation of new storage systems amounting to at least 6 GW by 2030, mainly to offer network services and located primarily in the south, followed by Sicily and Sardinia, on the market. For these systems – following the establishment of requirements by market area and before launching implementation projects – location criteria will first be established jointly with the Regions. The aim here is in part to avoid negative impacts on the environment, with due regard for the security requirements of the electricity system. At least 50% of the storage power required of the electricity system will be provided by pumping systems, and the remainder by electrochemical storage systems with a capacity/power ratio of about 8 kWh/kW. Sensitivity analyses have shown that, in the event of an increase in photovoltaic capacity (+4 GW) or a distribution of photovoltaic capacity concentrated more in the south (+2 GW) with respect to the scenarios adopted in the Plan, the capacity of the storage systems required could increase by, respectively, 2 GW and 0.5 GW, for a total of 6.5-8 GW.
- A high penetration of storage systems coupled with distributed systems (about 4.5 GW) is envisaged, mainly to maximise self-consumption (charging in the central hours of the day and discharging in the evening).
- Reduction of over-generation to values of around 1 TWh by 2030, by upgrading the network, introducing new dispatching resources and storage systems and making more use of existing storage systems.
- Encouragement of more pro-active and flexible electricity demand (demand side response) that could be an important resource, as in the case of electric vehicle recharging, for which it is necessary to foster the convergence of demand and supply peaks for non-programmable renewable sources through appropriate technological and market instruments and measures.
- Planning and implementation of developments on the network and associated meshing in line with procedures for planning the development of renewable energy systems, in order to make the transit of energy flows from south to north more efficient.
- Increased network resilience, including against extreme weather events, by adopting and implementing specific action plans, starting with higher risk areas, in order to protect continuity of supply and the safety of individuals and property.
- Simplification and speeding up of authorisation procedures relating to the performance of works connected to the above points, with improved stakeholder consultation and reporting, and awareness-raising amongst local populations.
- Integration of renewable gas sources by using existing gas system infrastructure for transport, storage and distribution.

The energy transition initiated by the INECP, and taken forward in even more radical terms by the long-term strategy, entails a gradual electrification of consumption and an increased share of electricity from renewable sources. However, it will continue to require, including in the medium-long term, an important role for the gas infrastructure. This can indeed play a decisive role to ensure the security and flexibility of the Italian electricity system, to encourage the integration of the new electricity renewables – for example through power-to-gas – and to foster the development, transport and storage of renewable gases such as biomethane and hydrogen. In this scenario, a growing interconnection between the two

networks and greater convergence between research and development plans is expected, as well as growing synergies in the operational management of the two infrastructures. Certain activities in the electricity-gas coupling sector were already launched in 2019. They include the following.

- electrification of some Italian storage and compression plants, transforming them into gas-electricity dual-fuel installations, reducing emissions, improving performance and, in effect, connecting the networks of the two TSOs to provide flexibility for the electricity system;
- a joint study by the two TSOs in line with the national and European strategic guidelines for the energy sector decarbonisation scenarios, as a preliminary step to drafting 10-year electricity transmission and gas transportation network development plans;
- from a perspective of joint adequacy of the two systems to address the growing penetration of non-programmable electricity renewables, cooperation on research activities on topics of common interest has been strengthened. These include: the use of programmable renewable sources, infrastructure analysis and monitoring, hydro-geological land analyses, site monitoring, the joint optimisation of electricity and gas networks, cybersecurity and flexibility.

2.4 Dimension internal energy market

2.4.1 Electrical interconnectivity

i. The level of electrical interconnectivity that the Member State aims for in 2030 in consideration of the electrical interconnection target for 2030 of at least 15%, with a strategy with the level from 2021 onwards defined in close cooperation with affected Member States, taking into account the 2020 interconnection target of 10% and the following indicators of the urgency of action:

- 1) price differential in the wholesale market exceeding an indicative threshold of €2/MWh between Member States, Regions or bidding zones;*
- 2) nominal transmission capacity of interconnectors below 30% of peak load;*
- 3) nominal transmission capacity of interconnectors below 30% of installed renewable generation.*

Each new interconnector shall be subject to a socioeconomic and environmental cost-benefit analysis and implemented only if the potential benefits outweigh the costs.

At national level, the development of cross-border electrical lines primarily refers to the projects for new public networks included in Terna's development plans, which are supplemented by new interconnections financed in whole or in part by third parties pursuant to Regulation (EC) No 2019/943.

As a result of a specific clause in its mandate from the TSO and the concession issued by the Ministry of Economic Development, Terna is obligated to manage and develop the interconnection capacity with the electrical systems of other countries, in order to ensure greater security and reduce supply costs for electricity.

The development of interconnectors financed by end customers, a policy implemented in the past decade, may also lead to a significant increase in the overall available transport capacity (programmed at 2 500 MW in Italy). The concession agreement requires the TSO to take these projects into consideration when defining the lines of development, with a particular focus on identifying the requirements for upgrading the network of interconnections with foreign countries. For the purposes of improving the capacity for long-term planning, it is worth stating that there are a large number of what are known as merchant initiatives still in effect in Italy, including with regard to authorisations granted.

The evaluation of the signals originating from foreign markets and the evolution scenarios of the electrical systems in Europe and in neighbouring countries indicates that the development of Italy's interconnection capacity will affect the following:

- the northern border (France, Switzerland, Austria and Slovenia);
- the border with south-east Europe, where there is a diversified and competitive production capacity that is growing in the mid-long term, as an alternative to gas and oil, on the basis of the resources present and thanks to the potential synergies with the electrical systems in the area.

The development of the interconnection capacity with north Africa may also be of strategic relevance, from a standpoint of the growing integration of Mediterranean countries with the

European market. Within this context, the Italy-Tunisia interconnection (ELMED project) represents an additional tool for optimising the use of energy resources. The project is included on the list of Projects Of Common Interest (PCI), having demonstrated positive effects in the mid- and long-term scenarios for Italy, Tunisia and other Member States of the European Union. However, in order for it to have strategic value and be economically feasible, the project needs substantial EU financing, primarily from the Connecting Europe Facility (CEF), as the cost of infrastructure of benefit to the Union cannot be borne only by those countries that are physically connected to it (Italy and Tunisia).

With regard to the 2030 target of 15%, it is noted that this target is currently calculated as the ratio between the Net Transfer Capacity (NTC) of the interconnections and the net installed generation capacity. In this respect, the increased output from non-programmable renewable sources projected for 2030 in the plan's scenario with targets (50 GW for photovoltaics alone)– sources that are, moreover, characterised by comparatively low productivity – makes it particularly difficult for Italy to attain the above target. The large number of non-programmable renewable sources also means that a significant share of thermoelectric generation capacity will have to be kept available, in order to ensure the necessary reserve margins to enable the system to operate securely.

Added to this problem is the fact that, geographically speaking, Italy is an outlying country of the Union, and therefore has less physical options to increase its cross-border interconnections, meaning that these need to be implemented in morphologically complex conditions (through Alpine mountain ranges or in underwater sections), with the resulting significant cost increases.

In any event, in Communication COM(2017) 718 final, the Commission proposes to operationalise the 15% target by drawing specifically on the three indicators suggested by the Expert Group on electricity interconnection targets, and on the respective thresholds in respect of which the need for new interconnections will be assessed, namely:

1. the price differential in the wholesale market exceeding an indicative threshold of €2/MWh between Member States, Regions or bidding zones;
2. nominal transmission capacity of interconnectors below 30% of peak load;
3. nominal transmission capacity of interconnectors below 30% of installed renewable generation.

In order to enhance these indicators for 2030, consideration was given to the interconnection⁵ projects listed in the following table, forming part of Terna's development plans for the national transmission network.

⁵ Only those interconnections with Member States of the Union and with Switzerland (as a country that only has interconnections with EU Member States) were taken into consideration for the calculation of the targets, as recommended by the Expert Group on electricity interconnection targets. The calculation thus did not include the interconnection projects with Montenegro and Tunisia.

Table 24 – Interconnection projects with foreign countries planned for 2030 with Member States of the EU (including Switzerland) [Source: Terna]

Interconnection projects planned for 2030 with Member States of the EU (including Switzerland)		
Border	Project ID – Ten-Year Network Development Plan (TYNDP) 2018	Project name
	336	Pirati-Steinach
	26	Reschenpass project (220 kV Nauders- Glorenza)
IT-AT	375	Lienz-Veneto 220 kV
	210*	ML Wuermloch-Somplago
	250*	ML Castasegna-Mese
IT-CH	174*	Greenconnector project (HDVC Verderio-Sils)
	31**	S: Giacomo project (All'Acqua-Pallanzeno/Baggio)
	21	Italy-France (HVDC Piosasco-Grand'Île)
IT-FR	299	HVDC SACO13
	150	Italy-Slovenia (HDVC Salgareda-Bericevo)
IT-SI	323*	ML Zaule-Dekani
	324*	ML Redipuglia-Vrtojba

* Merchant Line project not owned by Terna

** project under review

The development of further interconnection projects, with respect to those considered here, must account for the long timeframes resulting from the need to establish agreements

between countries and TSOs and to conclude authorisation, construction and start-up processes, as well as dealing with possible local opposition.

In any event, as stated by the Expert Group and endorsed by the Commission, the sine qua non for the creation of a new interconnector is that it be subjected to a socio-economical and environmental cost-benefit analysis capable of guaranteeing that the benefits outweigh the costs.

It is not currently possible to provide an estimate for indicator 1) in the absence of detailed information on the configuration of the electricity/energy systems of the other Member States of the Union planned for 2030, which will only be made available once the respective Integrated National Energy and Climate Plans have been published. Moreover, a reduced cross-border price differential would discourage the development of merchant initiatives, the economic justification of which is precisely that differential.

With regard to indicator 2), the estimated value for 2030 in the scenario with targets is 35%, which does not highlight any need for the development of further interconnections.

With regard to indicator 3), the estimated value for 2030 in the scenario with targets is 25%, which does not highlight any need for the development of further interconnections. As already stated above, however, although this value is not far removed from the threshold value of 30%, it is depressed by the considerable photovoltaics share (50 GW) projected for 2030 in the plan's scenario with targets.

2.4.2 Energy transmission infrastructure

i. Key electricity and gas transmission and distribution infrastructure projects, and, where relevant, modernisation projects, that are necessary for the achievement of objectives and targets under the five dimensions of the Energy Union Strategy

Electricity sector

With reference to developments in the electrical transmission network, all of the measures established in Terna's Development and Defence Plan (which previously analysed scenarios involving strong growth in renewables and for which reference is made to Terna's 2017 and 2018 Development Plans) must be implemented, as well as further network upgrades – with respect to those already scheduled in the 2017 Development Plan – between the areas of north, central-north and central-southern Italy, designed to reduce the hours of congestion between these sections.

In particular, the network analyses performed by Terna led to the identification of areas in need of action on both the primary transmission network 400-220 kV and the high-voltage network 150-132 kV.

The following cross-zonal measures are scheduled to be implemented by 2023:

- 380 kV Colunga-Calenzano electricity line
- 380 kV Foggia-Villanova electricity line
- 380 kV Bisaccia-Deliceto electricity line

The 380 kV Montecorvino-Avellino Nord-Benevento electricity line will be completed after this, as well as the redevelopment of the North Calabria network and the AAT/AT Middle Adriatic network.

In addition to the full implementation of Terna's 2016 and 2017 Development Plans, further development of the RTN for a 1000 MW increase along the Adriatic coast, as already provided for in the 2018 Development Plan, will also be promoted in order to reduce congestion.

Other categories of measure, including, for example, the Sardinia-Sicily-South HVDC connection proposed in the 2018 Development Plan, are also being evaluated.

The above measures will be supplemented by further investments in the distribution networks, which are increasingly affected by the spread of small and medium-sized installations. Alongside flexibility infrastructure, it is also important for the network to have devices to increase the controllability and stability of the RTN, including reactors, synchronous condensers and FACTS – Flexible AC transmission systems – able to regulate voltage and control loads in order to ensure high quality standards of the service and system security.

With regard to the electricity distribution network, the matter of estimating the overall extent of the modernisation measures needed to achieve the objectives is an extremely complex one, given the varied geographical placement of distributed generation (predominantly from photovoltaic conversion) and the electrification of end uses. For the latter, in particular, the most substantial effects are expected in areas having a high population density, whereas the effect of distributed generation is more recognisable in rural areas having a small load. In any event, the spatial coherence between generation and load does not guarantee a temporal coincidence between production and off-takes, with injections that are not consumed locally (by a single utility or by neighbouring utilities) possibly returning at higher levels of the network.

In the scenario involving an evolution trend, the estimated investment costs in the distribution network stand at €21.4 billion, which includes planned measures to increase resilience (at least €500 million in the period 2018-2022) and the roll-out of 2G meters (€4.8 billion).

Finally, for PCI projects on the electricity distribution network, reference is made to the ALPGRID project (PCI Connecting Europe Facility) at a cost of €5.85 million.

Gas sector

During 2018, the activities relating to the implementation of the project 'Support for the north-west market and cross-border bidirectional flows', the aim of which was to improve the flexibility and security of supply to the market in the north-west of the country and the creation of export capacity at the interconnection points at Tarvisio and Passo Gries (up to 40 MSm³/g overall), were completed.

The Snam gas pipeline connecting the TAP to the national transport network is currently under construction and is a continuation of the process to upgrade the transport network, including in relation to the solutions aimed at overcoming the difficulties associated with maintaining those sections of the network that cross highly urbanised areas. Both the national and the European natural gas transport infrastructure, as part of a network that was developed more than 40 years ago, are ageing. In this light, it is necessary to follow the planned interventions on the network in order to ensure continuity of the service to end

customers and to plan for adjustments to it as a result of the activation of new interconnections or supply routes.

In the gas sector, assessment and authorisation procedures are under way at the Ministry of Economic Development and the Ministry of Infrastructure and Transport for a number of small-scale liquefied natural gas (SSLNG) coastal storage facilities. These would be used to unload LNG from small tanker ships, store it and then transfer it to lighters (bunkering) and cryogenic tanker trucks to supply civil and industrial customers and fuel supply stations. In Sardinia, two of the three initiatives submitted envisage the coupling of SSLNG and mini-regassification facilities. This would be timely and cost-effective with a view to: (i) supplying natural gas to Sardinian industry, the existing urban distribution networks (to replace propane) that are already compatible with natural gas, and those under construction; (ii) replacing fuels used for heavy goods traffic; (iii) replacing traditional marine fuels with LNG by gradually introducing a 0.1% sulphur limit for port vessels and ferries; and (iv) using natural gas to fuel the thermoelectric power stations envisaged for the phase-out of coal-fired stations. Following the cost-benefit analysis initiated by Ricerca sul Sistema Energetico S.p.A. (RSE) on behalf of ARERA, which should be available in spring 2020, the most appropriate measures for the transportation of natural gas will be implemented.

To offer Sardinian users connected to the distribution networks prices that are in line with those applied in the rest of Italy, technical/regulatory solutions will need to be adopted that make it possible to equalise system costs and correlate the raw material price at the Virtual Trading Point (VTP).

ii. Where applicable, main infrastructure projects envisaged other than Projects of Common Interest (PCIs)⁶

Other major financed projects (non-PCIs) for the electrical distribution network:

- ALPGRID (PCI Connecting Europe Facility) €5.85 million
- PON I&C (Regions' objective): €80 million + additional resources of €61 million from the Ministry of Economic Development (additional €+120 + 27 million for the 'supplementary' transmission network)
- PAN Puglia Active Network (e-distribution): €170 million (NER300 tender)
- ERDF ROP 2014-2020 Axis I Research and Innovation: €290 million

2.4.3 Market integration

i. National objectives related to other aspects of the internal energy market such as increasing system flexibility, in particular related to the promotion of competitively determined electricity prices in line with relevant sectoral law, market integration and coupling, aimed at increasing the tradeable capacity of existing interconnectors, smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching,

⁶Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009 (OJ L 115, 25.4.2013, p. 39)

re-dispatching and curtailment, and real-time price signals, including a timeframe for when the objectives shall be met

An increased flexibility of the system is undoubtedly one of the national objectives relating to the internal energy market. This objective will be achieved through increased flexibility of existing thermoelectric production facilities and, above all, by increased market participation of new flexible resources. These new flexible resources include aggregation and demand response, a greater participation of distributed generation and non-programmable renewables in services markets, and the development of new storage systems.

The objectives to be pursued are coherent with the transition towards a market structure that is integrated and coordinated at European level, that focuses on active and aware consumers, and in which the participation of distributed resources will take on increasing significance. These objectives relate, in particular, to the following.

a) strengthening the process of market integration

Over the last few years, the EU's drive to harmonise the national regulatory frameworks for the functioning of electricity markets towards an integrated electricity market have intensified. The European network codes adopted between 2015 and 2017 and, in particular, those relating to capacity allocation and congestion management (Regulation (EU) 2015/1222) and balancing (Regulation (EU) 2017/2195) outline a detailed market model, in terms of both electricity trading and the supply of dispatching services. In this context, the Integrated Electricity Dispatching Text, which is nearing completion following the consultation (Consultation Document 322/2019/R/eel), establishes the overall guidelines. In addition, the full implementation of the Clean Energy Package will provide a new impetus to the processes currently under way to harmonise the functioning of the markets. The following measures are involved.

- Italy's day-ahead market (DAM) has already been integrated through market coupling with France, Austria and Slovenia; this will also be implemented in the future on the borders with Greece and Switzerland (the latter being subject to the outcome of negotiations between Switzerland and the EU on the subject of energy markets);
- the timeframes for implementing the European model for the intraday market (IM) appear to be longer. Trading as close as possible to real-time will make it possible to promote greater integration of renewables and active market demand. The European project CrossBorder IntraDay (XBID), supported by the network and market operators of various Member States, including Terna and GME, recently entered its operational phase. Italy will adhere to this project at a later date (2020) once coordination measures between the IM and the dispatching services market (DSM) have been implemented;
- with reference to the integration of balancing markets, the aim of Regulation (EU) 2019/943 of 5 June 2019 on the internal market for electricity is to develop common platforms for trading flexible resources and services between the network operators of EU countries. In this way, the cross-border offsetting of imbalances and the acquisition of capacity and energy in another market area will be encouraged and, more generally speaking, common methodologies for the coordinated calculation of national reserve requirements will be adopted. The process for harmonising the rules on balancing appears to be more sensitive, as it impacts on the operations of network operators on deadlines close to real-time and, therefore, on

system security in the short-term. A number of pilot projects have already been launched in this respect, including the TERRE project, in which Terna has an interest, for designing, developing, implementing and managing a platform for exchanging replacement reserves between the various participating countries (currently Italy, France, Spain, Portugal, the United Kingdom and Switzerland).

It should also be noted that Regulation (EU) 2019/943 introduced an obligation to make available to the market at least 70% of available capacity on each border (calculated taking into account the meshing of the grid and secure network operation (N-1)). It envisages, once the methodology has been approved by all regulatory authorities, a review of the configuration of the bidding zones at the European level. As regards the first point, following the analyses currently under way the option of a temporary derogation, as envisaged by the Regulation, will be evaluated.

b) promoting the active role of demand and the integration of renewable sources and distributed generation.

With regard to the roll-out of distributed generation and self-consumption, Italy is well placed in the future market trends outlined by Europe. In 2017, the amount of electricity self-consumed was approximately 28 TWh, more than 9% of total consumption (data provided by Terna), whereas distributed generation (considering all installations connected to the distribution networks) accounted for more than 20% of overall electricity generation in 2016 (data provided by ARERA). This is a growing phenomenon that needs to be regulated on the basis of efficiency and security criteria with the following priorities:

- to consolidate the awareness of and active role played by the consumer, who becomes a key figure in the transition towards an increasingly decentralised system; the role of the consumer is shifting from a passive onlooker to an active participant, capable of modifying their consumption in response to price changes on the market and, under certain conditions, to self-produce and offer network services;
- the active role of the consumer may take three forms:
 - choosing a supplier and properly evaluating sales offers and associated services;
 - self-production and adoption of storage systems and efficient management of consumption;
 - modifying load in response to price signals (demand response).

With regard to the first point, in the coming year the Italian authorities will, in coordination with the regulator, carry out initiatives to raise awareness, improve transparency of communications sent to consumers, and define qualification requirements for operators on the retail market, including with regard to the reliability and accuracy of contractual obligations and compliance with competition rules and the sectoral regulations currently in force. These are necessary steps towards greater consumer awareness and protection, prerequisites for the abolition of price protection schemes, which the Italian authorities recently established should take place on 1 January 2022 (Article 12 of Decree-Law No 162/2019). They are thus taking the necessary time to ensure that complete price liberalisation benefits consumers and preserves consumer protection mechanisms under fair and sustainable conditions.

The development of widespread self-generation may express itself through various configurations, both individual and collective, in an industrial/commercial context or as an

expression of civil initiatives aimed at social and environmental issues: existing self-consumption structures may work alongside new forms of aggregation (such as, for example, the new figures of ‘self-consumer’ and ‘energy community’ established by the Clean Energy Package and specifically by RED II), which will require the definition of government instruments to ensure system security, consumer protection and the fair allocation of network and system charges. The spread of self-consumption will naturally be facilitated by technological developments (for example the possibilities posed by new smart meters, the roll-out of digital technologies, together with the internet of things) able to deliver small and medium-sized production and storage systems, above all using renewable sources and high-efficiency cogeneration, and entail smaller and smaller costs for users. This is a phenomenon that must be supported through public policies enabling market actors to organise themselves on the basis of efficiency criteria. To this end, the regulation of the new structures must be accelerated.

In the long-term, the dispatching model itself will be aligned with market developments, tending towards models that are better tailored to a distributed resource system, with the need to ensure security at the lowest possible cost. A ‘self-dispatching’ model currently prevails in Europe, differing from the dispatching arrangements in Italy, which are based on the central dispatch model. In ‘self-dispatching’ models, the dispatching of resources is not bindingly determined by the network operator, but is instead referred to the agents responsible for scheduling in-puts and off-takes, who are encouraged to balance their positions on the basis of a system of incentives/penalties.

With the increasing participation of distributed generation, the current central dispatch model might not be fully appropriate in the future; the most suitable model for the national context will therefore have to be assessed on the basis of efficiency and security criteria, with strongly standardised models being avoided. In terms of the shift towards a more decentralised system, sufficient time must be allowed for its organisation and for preventive measures, both organisational and structural, relating to the regulation and management of the distribution networks and the methods of cooperation between the DSOs and TSOs. A gradual approach that promotes a more active role being played by DSOs, to whose networks the distributed resources are connected, is therefore advisable.

With regard to the gas market, liquidity must be increased and the price spread with respect to other European markets reduced: full integration with the markets of north Europe should eliminate/greatly reduce the differential between the Title Transfer Facility (TTF) and VTP, thus allowing Italy to compete with the markets of north Europe in attracting LNG which, in market conditions of oversupply, should generate positive competition and lower absolute prices.

The Ten-Year Network Development Plans (TYNDP) of the Italian TSO (Snam) and German TSO (TENP) for the partial or total reactivation of the out-of-service TENP gas pipeline, in cooperation with the Swiss TSOs and German and Italian regulators, will also be addressed, by optionally introducing methods to implement the measure, including on the part of the Italian system, following a cost/benefit analysis demonstrating that, in order to cover such a cost, the differential would be reduced (structurally equal to approximately €2/GWh on all volumes of gas consumed in Italy).

ii. Where applicable, national objectives related to the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets, including a timeframe for when the objectives are to be met

Within this context, the following measures should be taken:

- complete the procedure authorising distributed renewables generation to participate in the services market and the full exploitation of demand and other flexible resources (including storage systems), in accordance with principles of technology neutrality and cost minimisation, through new organisational structures. The following steps should therefore be taken:
- eliminate the barriers that continue to restrict participation by all available resources in the various electricity and services markets;
- promote a level playing field between the different types of resources, including in terms of responsibility (for example in relation to the application of imbalance costs and exceeding the dispatching priority for renewable sources).

In this respect, it is necessary to accelerate the reform process for the dispatching services market, starting with the trials currently in progress as part of the pilot projects developed by Terna, implementing Legislative Decree No 102/2014 and ARERA Resolution 300/2017. These provisions regulate participation in the services market and distributed energy generation, renewable sources, HEC and demand, including by means of aggregators, in the light of ARERA's drawing up the Integrated Text on Electricity Dispatching. This will take the results of the consultation (Consultation 322/2019/R/eel) into account and will be consistent with the European balancing code (Commission Regulation (EU) 2017/2195).

The development of the rules governing imbalances should also be set in this context. They will be based on setting a value that is as close as possible to that of the energy used for balancing in real time. The aim is to provide operators with all of the information they need to make efficient decisions on buying or selling electricity and on network use, and to allocate the costs of any imbalances more accurately. This development will initially take into account the specificities of the current centralised dispatching model, as used in Italy. In particular, and in implementation of the provisions of Article 8(4) of Regulation 2019/943 on the internal market for electricity, a settlement period of 15 minutes will be established, including for non-approved units, in the light of a more comprehensive review of the difference between approved and non-approved units that takes into account the possibility of maximising the market participation of the available resources.

In addition to promoting fuller integration with the other European markets, the reform process implemented by ARERA will help achieve the following objectives.

- Sustainability, as the increased opening up of the dispatching services market allows more efficient integration of renewable sources into the market and electrical system.
- Competitiveness, insofar as the increased availability of resources and technologies capable of providing the requested service enhances competition between operators, with potential positive effects on service cost dynamics and the risk of abuse of dominant positions.
- Flexibility, as a separation is introduced between operators' portfolio trading activities and the physical programming of resources, thus enabling the fullest possible freedom and flexibility in electricity market participation.
- The development of storage capacity. This objective primarily aims for efficient integration of renewable sources into the electrical system, in order to reduce over-generation, in line with network developments and according to the regulation requirements of the network operator. A sufficient storage capacity (both distributed and concentrated) is of significance in view of the growing importance of non-programmable renewable sources and the resulting increased demand for

flexibility, as well as the planned phase-out of coal-fired thermoelectric capacity by 2025. In addition to reducing over-generation of renewable sources, the roll-out of storage systems will also influence zone price differences between the south and north caused by network congestion. Nowadays, hydroelectric storage systems represent the most mature option of the various storage technologies, although they are not sufficiently exploited and, therefore, not replicable.

Other possible storage solutions that envisage the use of alternative means of delivering energy, such as hydrogen, could also be investigated. With regard to batteries, Terna has developed a number of applications, on a trial basis, for 75 MW of capacity intended to provide vital services (primarily power-driven applications). In the future, due consideration must be given to the new EU provisions that provide for the development of storage systems in line with market principles, limiting the role of distribution and transmission network operators to instances involving market failure. The definitive choice of storage capacity to be achieved, storage technologies, and the mixture between network measures and the construction of storage facilities, will be described in Terna's development plans on the basis of the services that will be offered by each option (power-driven, energy-driven or multi-service) and the need to optimise the use of pre-existing hydroelectric storage facilities. The roll-out of storage systems may also be driven by developments in the automotive sector; to this end, it will be important to enhance the role of electric cars and associated infrastructure when providing network services.

Still on the theme of increased participation of demand, the objectives include the provision of off-take and electricity consumption data to the end customer and third parties identified by that customer, in order to increase energy efficiency, including through greater customer awareness with regard to their consumption patterns. By way of Resolution No 87/16, the ARERA established the functional requirements for low-voltage smart meters and performance requirements for associated second-generation smart electricity metering systems ('2G meters'). Resolution No 669/2018/R/gas recently defined the obligations for commissioning smart gas meters in classes G4-G6, which represent 97.8% of the total number of redelivery points for distributors with more than 50,000 end customers.

iii. Where applicable, national objectives with regard to ensuring that consumers participate in the energy system and benefit from self-generation and new technologies, including smart meters

See sections 3.1.2 i and 3.4.3 ii for a detailed description of the objectives in terms of promoting self-consumption and developing and supporting renewable energy communities, to be achieved primarily through regulatory instruments.

iv. National objectives with regard to ensuring electricity system adequacy, as well as for the flexibility of the energy system with regard to renewable energy production, including a timeframe for when the objectives are to be met

The adequacy of the electrical system is a central objective of energy policy and is also the reason why Italy, which experienced a period of overcapacity, but is now, by contrast, going through a phase of gradual reduction in its conventional capacity, has prepared an instrument capable of promoting new investments in generation, storage systems and demand response (capacity market). Adequacy is subject to periodical analysis and review by Terna, both in the

mid-long term and in the short-term, with a particular focus on periods of increased seasonal demand and specific external challenges. On the other hand, the rapid evolution of the energy system necessitates systematic and continuous monitoring and assessment activities. A first analysis of the adequacy of the system for 2030 was carried out in 2017, which also included the phase-out of coal-fired production. It will be updated annually to take into account the changes introduced by this Plan and the methodologies that will be established in implementing Regulation 943/2019. According to the analysis available, in order to maintain adequate security margins for the system, new substitute resources, primarily in terms of renewable generation, will need to be developed, together with new conventional power sources and storage devices, in coordination with the projected developments in network infrastructure (the results of the analysis and the list of infrastructure to be built are attached to the 2017 National Energy Strategy).

In particular, flexibility requires a strong push for new storage systems that give benefits not just in terms of shifting production from the peak of non-programmable renewables (photovoltaics and wind power in particular) towards hours of increased consumption, but also in terms of providing the system with the actual services needed for security, including as a replacement for thermoelectric production units. Still on the issue of flexibility, the active participation of demand on the markets makes a significant contribution; this kind of contribution will be encouraged by building on the experience gained from the pilot projects launched by Terna, which can undoubtedly be of benefit to technological development by enabling the spread of demand response configurations, as well as the evolution of new players, such as aggregators and energy communities.

In addition to storage facilities and the active participation of the demand side in the markets, in view of the expected changes in demand for electricity and the decommissioning of coal-fired power stations and the remaining fuel-oil installations, it will be necessary to create additional gas-fuelled generating capacity. This will lead to a temporary increase in gas consumption, for which no infrastructure development is currently envisaged. Gas-fuelled capacity will therefore make a strategic contribution to covering requirements.

v. Where applicable, national objectives to protect energy consumers and improve the competitiveness of the retail energy sector

Generally speaking, the price gap in the electricity sector with respect to the European average remains, although it is decreasing. This difference is the result of:

- a higher wholesale energy price, resulting from:
 - a gas price (Italy's primary and marginal source) that is still higher than the European average;
 - an energy mix strongly shifted towards gas-fired combined-cycle plants which, although more efficient, have higher variable costs than coal-fired and nuclear power plants and are actually present at an even higher level in European energy mixes;
- increasing costs for network services, as a result of the greater complexity entailed in operating a network in a country with its own particular mountain terrain, and of Italy's production mix having one of the highest shares of renewables in Europe;
- high system charges, primarily as a result of support policies for renewables and energy efficiency that have a higher impact than those of other EU countries.

The objective of limiting all those aspects that contribute to this price disadvantage and the impact of consumer charges for the development of renewable sources is therefore confirmed, in order to protect consumers' purchasing power and the competitiveness of SMEs and energy-intensive industrial sectors, and thereby preventing relocation risks and safeguarding employment.

Promoting the active role of consumers is closely connected to improving transparency and competitiveness on the retail market. In this respect, it is essential that this objective be attained as soon as possible, in coordination with the completion of the process to liberalise the retail market outlined by Competition Law No 124/2017, which will result in the current price regulation regime (known as the 'Enhanced Protection' scheme) for domestic consumers and small enterprises being brought to a definitive end. The measures which the government intends to promote, in coordination with ARERA, are targeted, on the one hand, at providing consumers with more knowledge and an awareness of the opportunities and benefits presented by the market, and, on the other hand, at ensuring effective competition between suppliers. Notwithstanding the measures that still need to be implemented, it is emphasised that the starting point is an overall context that in recent years has seen improvements in the information and protection instruments offered to consumers to develop greater awareness and properly guide their choice of supply.

These include, to mention just the most important ones, the energy consumer help desk, the mediation service, the supplier comparison portal, the integrated information system (IIS), and the consumption portal managed by Acquirente Unico Spa. This portal, which began operating in 2019, also meets a need that was underscored in the consultation on the Plan, i.e. the need to make all of the metering data held by distributors available to end-customers. In addition, ARERA has introduced new rules in relation to invoicing and the associated timeframes and has reformed switching processes. The aim is to ensure greater transparency and standardisation by revising deadlines and procedures and providing stronger consumer guarantees. For further details, see Section 3.4.3., which describes the measures mentioned here in greater depth.

2.4.4 Energy poverty

Where applicable, national objectives with regard to energy poverty, including a timeframe for when the objectives are to be met

The share of household expenditure set aside for the purchase of electricity and heating has gradually increased over the course of the first decade of the 2000s, in particular with regard to increasing expenditure on electricity consumption. This trend was consolidated, and exacerbated, in the years immediately thereafter, including as a result of the economic crisis that hit Italy and brought with it a decrease in the overall average level of household expenditure (which fell by more than 5% between 2008 and 2013). The effect on energy expenditure was not uniform across the various sections of the population, insofar as it weighed more heavily on the most deprived households. Indeed, in 2016 the 10% of households with the lowest levels of consumption spent 4.5% of their overall expenditure on electricity, while for the 10% with the highest levels of consumption electricity expenditure accounted for 1% of total spending (the shares for heating are 4.5% and 2%, respectively). Comparing the trend in the volume of expenditure taken up by energy products between 2007 and 2016, it is noted that the largest increases were recorded by the most deprived households.

A gradual increase in household resources earmarked for energy expenditure might exacerbate the phenomenon of energy poverty (EP), understood to mean the inability to purchase a minimum energy basket of goods and services or a situation where access to energy services entails a diversion of resources (in terms of expenditure or income) higher than the socially acceptable level.

This issue is increasingly in the spotlight of European and Italian institutions. The European Energy Poverty Observatory was established in 2017 at the initiative of the European Commission, tasked with producing reliable and comparable statistics, establishing good practices and tackling the issue through the involvement of stakeholders.

Italy has no official definition of energy poverty. In the SEN approved in November 2017, an ad hoc indicator⁷ was adopted to measure its extent. According to that indicator, in the period 2005-2016 the proportion of households in energy poverty was, on average, approximately 8% of all households. However, the percentage has grown in recent years, to about 8.6%, which equated to 2.2 million households, in 2016, a figure that was more or less unchanged in 2017. The trend is essentially the same as for the proportion of households in relative poverty, according to estimates provided by Istat.

To identify targets for reducing EP, an understanding of its main determinants must be gained. Four determinants may be identified in this respect:

1. trends in residential energy consumption and the mix thereof used: in the INECP scenario, residential consumption in 2030 should fall by 15.5% (-1.4% each year) compared with 2016, with a growth in the electricity component (of 7.2%) against a reduction in gas (by almost a quarter) and a slump in oil products, which are increasingly marginal;
2. expected price trends for energy products: prices for energy products (including tax and system components) should increase – according to the European Union’s projections for Italy (EU Reference Scenario 2016)⁸, the final price of electricity should increase by 0.6% each year, with no information being available on the price of gas or other energy products. Overall, energy expenditure could increase by 1.3% each year if it follows the same trend estimated for the item ‘Total energy-rel. and other mitigation costs’ in the same scenario;
3. trends in overall household expenditure: household expenditure could increase to an annualised rate of 0.8% if it follows the trends projected for real GDP in the aforesaid EU Reference Scenario;
4. demographic changes: the number of households in EP will also be determined by demographic trends. Households with an elderly member or with only one member are less likely to be in EP, and the number of households with these characteristics will increase in the future. The projections formulated by Istat with regard to population evolution to 2030⁹ suggest that the number of people over the age of 65 should account for a quarter of the total in that year, an increase of three percentage points compared with 2017, and that the number of households should increase due to the continuing trends towards fewer average members¹⁰.

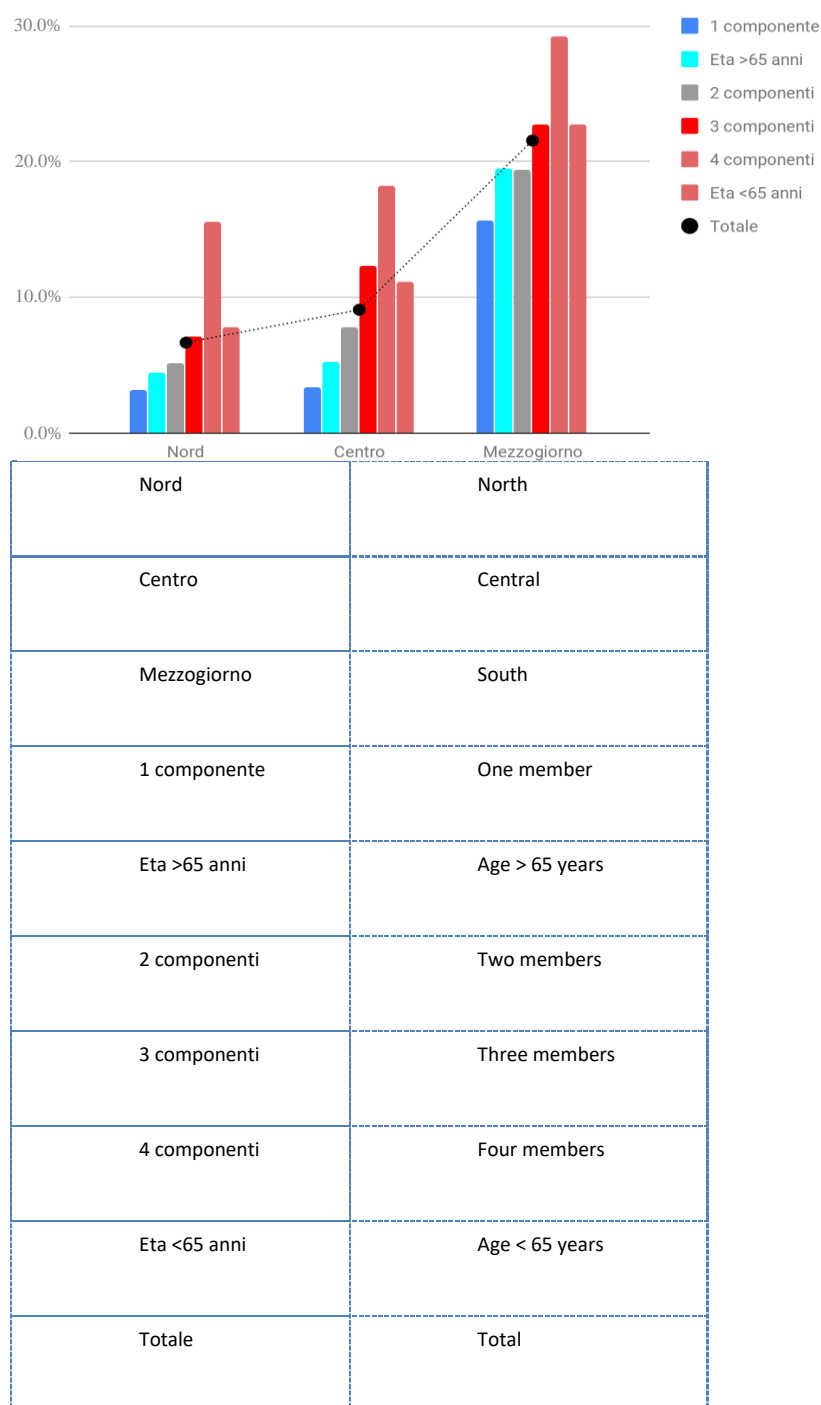
⁷ Faiella I. e L. Lavecchia (2015), “La povertà energetica in Italia”, *Politica economica*, Società editrice il Mulino, n.1, pp 27-76.

⁸ The information for the EU scenario as a whole and for Italy is available at: <https://ec.europa.eu/energy/en/data-analysis/energy-modelling>.

⁹ https://www.istat.it/it/files//2018/05/previsioni_demografiche.pdf.

¹⁰ See Figure 3.4 of the Italian Statistical Yearbook for 2017. Assuming that the average number of members will fall from 2.4 in the

Figure 21 – Households in energy poverty in 2016 by geographical area, age and size of household (Source: calculations on the basis of data from the survey on household expenditure carried out by Istat)



Taking these and other factors into account, it can be assumed that the incidence of energy poverty could decrease in the coming years, to remain at between 7% and 8%, with a reduction of about 1 percentage point with respect to the 2016 figure (which would correspond to a reduction of about 230,000 households in energy poverty, again with respect to 2016).

period 2014-2016 to 2.3 in 2030, the number of households should increase by almost 4%.

All this having been said, in order to tackle energy poverty, the efficiency of existing measures in support of energy expenditure must be increased and, in the mid-term, solutions to increase the energy efficiency of buildings must be prioritised.

With regard to enhancing electricity and gas bonuses, measures must be implemented to scale the size of the benefit on the basis of poverty conditions and to improve access to the measure for households living in conditions of financial/physical hardship. In this respect, ARERA estimates that, to date, only about a third of potential beneficiaries has requested access to the benefit; the low levels of use can be attributed to various different factors, including a lack of awareness of the measure itself and the administrative complexity of the requirements established. The objective, therefore, is to reach all of the potential beneficiaries by removing administrative barriers and introducing, as far as possible, automated tools for granting financial support. In this context, account will also need to be taken of any specific needs, including those relating to households that use alternatives to methane for heating purposes or households that do not have heating systems.

There is also room for policy measures which, in the mid-term, promote a reduction in energy demand for those properties inhabited by deprived sections of the population, through measures to enhance efficiency and complete renovation of public residential buildings (social housing). These types of measures require investments which households living in poverty, which cannot easily access normal energy efficiency incentives, are not able to make. The above measures will pursue various different objectives simultaneously, namely enabling more efficient use of energy resources taken up by the residential sector (with positive effects on comfort and emissions), reducing the burden of energy bills for the most vulnerable households, and adding value to public housing stock.

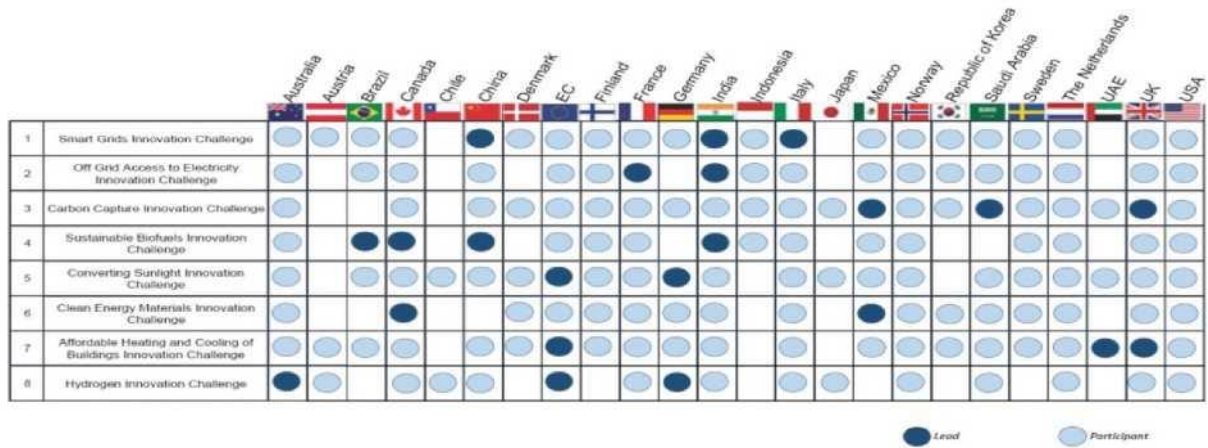
The instruments available in Italy today – electricity and gas bonuses, tax deductions for energy renovation works (what is known as the ‘Ecobonus’), the thermal energy account (Conto Termico) – can, if appropriately modified and coordinated, tackle the phenomenon of energy poverty in our country. To this end, it will also be beneficial to establish an ‘official measure’ of energy poverty, understood to mean the inability to purchase a minimum energy basket of goods and services, or, alternatively, in the sense of energy vulnerability, when the access to energy services entails a diversion of resources (in terms of expenditure or income) higher than a ‘normal value’.

2.5 Dimension research, innovation and competitiveness

i. National objectives and funding targets for public and, where available, private research and innovation relating to the Energy Union, including, where appropriate, a timeframe for when the objectives are to be met

On an international level, during the COP 21 in Paris, Italy signed up to the multilateral initiative which aims to promote an acceleration of technological innovation to support the energy transition by means of a significant increase in public funding dedicated to cleantech research. The initiative comprises a series of ‘Innovation Challenges’.

Figure 22 – Leading countries and participants in the 8 Innovation Challenges of the Mission Innovation initiative



Italy took on the role of co-leadership, along with India and China, in the development of smart grids, its commitment to which has been well-known since the G8 meeting in L’Aquila in 2009, which led to the establishing of the ISGAN initiative (Implementing Agreement for a Co-operative Programme on Smart Grids) under an International Energy Agency framework. Regarding the other challenges, Italy has made the decision to be present, to potentially play an important role and to be ready, with its principal public research bodies and organisations, to contribute to the work groups that have been established on a voluntary basis, confirming an interest in participating in the work or at least in exchanging information about the activities. The national research system, other than smart grids, has shown interest in particular in alternative fuels, advanced energy materials, zero emission heating and cooling, and hydrogen.

The Italian Ministry of Economic Development, instructed by the President of the Mission Innovation Steering Committee, has created two levels of governance: the first with a task force of the ministers involved (Foreign Affairs, Environment, Education and Economy and Finance) and responsible primarily for the doubling of public funds, the second with an ‘operational’ task force, represented by the main public research organisations overseen by ministers: the National Agency for New Technologies, the National Research Council, and RSE S.p.A., to which were subsequently added the National Institute for Oceanography and Experimental Geophysics and the Italian Institute of Technology.

Italy views the Strategic Energy Technology (SET) Plan as a fundamental instrument for meeting the new challenges posed by decarbonisation and agrees with the role the Commission has assigned to it in setting the objectives of the present Plan. Since the SET Plan was first introduced, Italy has progressively aligned its objectives and priorities for public investment in research and innovation in the energy sector with those of the SET Plan. As confirmation of this commitment, Italy follows all of the key actions of the SET Plan with its own experts, who have set up standing consultation groups with businesses and national research bodies, and engages in collaboration with other Member States that has often translated into joint participation in Horizon projects.

In addition, the conception and construction of the Innovation Challenges envisaged by Mission Innovation to a large extent reflect the SET Plan methodology and there are significant synergies between the two. Italy therefore considers the systematic and integrated management of research in the energy sector to be necessary, both for the SET Plan and for Mission Innovation, in order to improve efficiency and the effectiveness of the allocated resources.

In the course of drawing up this plan, we would like to take the opportunity to determine a long-term strategy (at least until 2030 and possibly to 2050) that indicates the objectives and priorities, and defines the essential measures for achieving the objectives identified, as well as reviewing priorities, guidelines and evaluations of competitiveness in the energy technology sector. The objective is to create the conditions for a system where the participation of industry and public and private Italian research centres in future research programmes provided either by the SET Plan/Horizon Europe or Mission Innovation is broader and less fragmented, effectively offers the opportunity to play a more decisive role and which has better success than has been achieved in the past.

The principal objectives aim to:

1. monitor and develop product and process technologies vital to the energy transition;
2. promote the introduction of technologies, organisational and operational models and systems used for the energy transition and for safety.

In particular, the research subjects concern:

Goal 1) monitor and develop product and process technologies vital to the energy transition:

- development of components and systems for highly efficient photovoltaics, which allows better exploitation of occupied areas and provides opportunities for new entrepreneurship;
- development of storage systems, including thermal, electrochemical and power-to-gas, and related interfaces with the networks, in order to guarantee high levels of penetration for non-programmable renewables;
- development of power-to-gas storage systems, particularly for the purpose of storage of excess production of non-programmable renewables by means of secure and reliable storage of hydrogen in liquid and gaseous energy carriers;
- investigation of new options and advanced materials used for different applications in the energy cycle;
- development of components and materials to improve the security and resilience of electricity networks;

- development and optimisation of technologies, components and materials to increase energy and environmental performance of buildings;
- improvements to the energy efficiency of industrial products and processes, in particular with the development of techniques and plant solutions for boosting efficiency of industrial processes at high and low temperature;
- in accordance with Key Action 3.2 of the SET Plan, which provides for the creation of Positive Energy Districts, the research and development of second-generation smart buildings, entirely based on electricity consumption and characterised by energy autonomy, increased flexibility, blockchain dialogue systems and smart contracts with the network, supported by integral monitoring methods;
- study and implementation of methodologies for development of energy communities and definition of enabling technologies for the promotion of energy efficiency through consumer awareness;
- in terms of mobility, the trialling and testing of various storage systems, as well as the development of innovative thermal electronic and battery controls for electric vehicles;
- monitoring for purposes of safety and second-life use, devices for V2H (Vehicle To Home);
- study and trialling of infrastructures for high-power electric recharging for local public transport, including through use of charging solutions incorporated along the route;
- development of technologies for effective penetration of electricity carriers into end-use: in particular, research activities will be concentrated on complex heat pump systems or linked to non-conventional storage systems; study will also be made of the use of heat pumps at high temperatures in industrial processes in order to recover residual heat;
- as regards renewable energy from the sea, the development of diverse solutions is planned for floating platforms capable of supporting complex sea conditions and the study of innovative materials for new kinds of high resistance anchoring and for coupling these to the floating platforms.

Goal 2) promote the introduction of technologies, organisational and operational models and systems used for the energy transition and for safety:

- development of architectural and operational models for the system and for electricity networks which promote the integration of renewable, non-programmable energy production, self-production, storage, energy communities and aggregators, and which take into account electrical penetration;
- application of advanced information technologies, the internet of things, peer to peer electricity trading, to improve the safety and resilience of networks;
- development of models and instruments to increase penetration of electricity carriers in the transport sector and to improve corresponding integration and interaction with the electricity system;
- creation of demonstrators on a local-community level in order to establish innovative methods of management and control of the electricity network by means of a distributed approach, with the aim of increasing energy efficiency in the cycle of production, transport and distribution of electricity;
- continue with the task of modernising electricity networks, including in the short-term, with a view to smart grids. The increase in distributed generation in fact requires real transformation of the distribution networks and of the related operational modes, with modernisation both of the hardware component (e.g. to also make

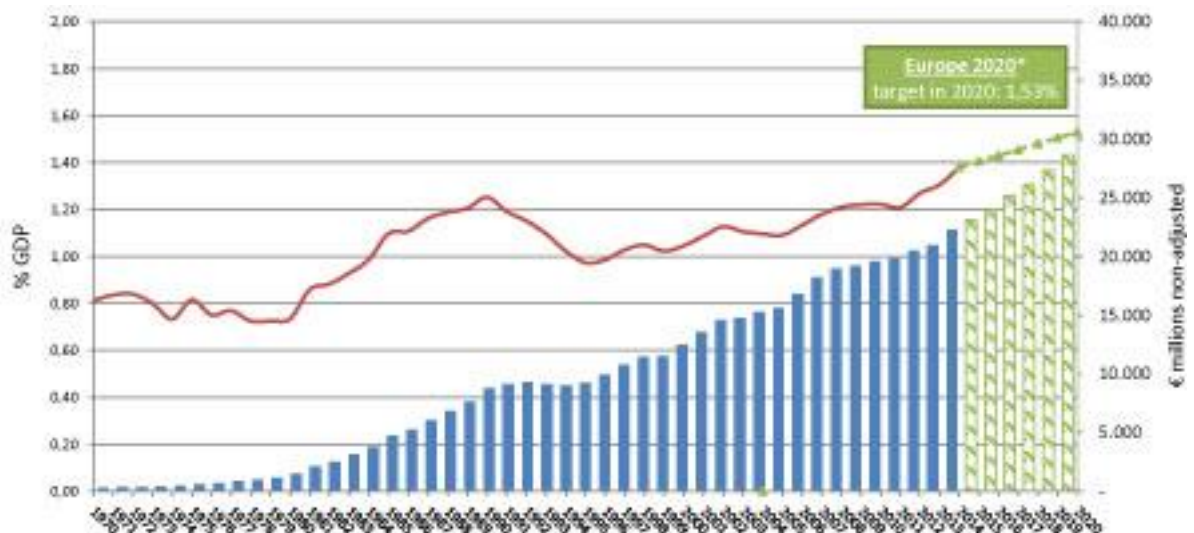
distribution networks also bi-directional) and of the software component (e.g. to enable demand response management initiatives).

As regards financial resources in the context of Mission Innovation, Italy has undertaken to double the value of the resources portfolio for public research in the field of clean energy, from around €222 million in 2013 (the year taken as the baseline) to around €444 million from 2021, which represents for all intents and purposes the minimum commitment necessary to guarantee that the indicated targets will be reached.

As a guideline, the graphic below shows the evolution of expenditure for research and development (R&D) in Italy from 1963 to 2013, with a projection for the years to come up to 2020. In the context of the Europe 2020 strategy, Italy has adopted an expenditure target up to 2020 equal to 1.53% of GDP.

For measures to make electricity networks smart, in addition to the higher remuneration provided by the ARERA, other resources are also used where possible, in particular those from the European Structural Funds Programme.

Figure 23 – Trend in R&S spending



ii. Where available, national 2050 objectives related to the promotion of clean energy technologies and, where appropriate, national objectives, including long-term targets (2050) for deployment of low-carbon technologies, including for decarbonising energy and carbon-intensive industrial sectors and, where applicable, for related carbon transport and storage infrastructure

Looking ahead to 2050, it becomes imperative to rationalise and improve research and innovation in the energy sector, indicating national and funding objectives for research and innovation, both public and private. These objectives will have to be consistent with the priorities of the EU energy strategy and the SET Plan. These forecasts, although not consolidated, may however be a useful point of reference, on the basis of which we can reflect to better identify the technological options to prioritise, taking into account the strengths of the national system and the system requirements. In that regard, national instruments, European and national programmes will be used in a coordinated manner.

Following the intense work carried out by the Italian Delegation as part of the working groups set up by the SET Plan for the implementation of the Key Actions, it is considered that renewable sources – among them solar PV and CSP in particular, and, in the longer term, sea energy (wave, tidal and current energy), storage systems (including hydrogen and power-to-gas and, more generally, the integration between the electricity system and other systems), system devices for safety of the electricity system, electric mobility, biorefineries, materials, processes and systems for energy efficiency of the industry and of buildings represent the subjects that have, concurrently, sufficient focus among research bodies, a considerable industrial basis and are of significant interest to the system, not only for the 2030 objectives but also and especially in the longer term view, looking ahead to 2050.

In particular regarding advanced energy materials (developed in particular as part of the IC6 of Mission Innovation and of the Electricity System Research Fund), the small and medium-sized businesses that make up a large part of the Italian industrial framework active in the sector have emphasised that is essential to initiate standardisation of the format of data, define the methods of collection, use and sharing of information and how correct management of intellectual property is an indispensable element to support the creation of this platform to accelerate the discovery of materials.

Italian participation in Mission Innovation therefore constitutes an opportunity in the coming decades for Italian industry operating in the sector of energy materials to participate in highly innovative research projects at a pre-competitive level, adopting a revolutionary and innovative approach to the discovery and development of new materials, which will form the basis for significant reinforcement of national companies in the sector on an international level. The increased potential for growth of clean energy technologies, the relevant role of the production of advanced materials, the skills of Italian researchers and the manufacturing tradition of our companies, especially small and medium-sized businesses, together with national energy strategies which focus decisively on decarbonisation, create conditions very favourable for public investment in research into energy materials to be transformed into a potent engine for industrial growth and qualified employment.

A lot can be done in Europe in the future, including in terms of development of infrastructure and digitalisation, and the margins for growth and improvement seem large, for Italy at least. This improvement must surely also take into account energy storage systems, which will certainly play a leading role in the future. It will be difficult to move towards decarbonisation in the energy sector without substantial progress in energy storage technologies. In particular, obstacles of a technical nature persist: beyond the specific technology, it is necessary to develop power, capacity, speed of reaction, efficiency and to reduce costs.

To achieve these results, given the need for substantial investment, it is of fundamental importance to create broad alliances on a European level and beyond, which bring together all of the parties involved (institutions, universities and research centres, companies) to support R&D activities in the sector and facilitate the introduction of new technologies onto the market, also developing measures that relate to the legislative and regulatory framework, with the aim of removing the barriers to entering the market and maintaining the attraction of financing and return on investments. In this respect, synergies in the university, research and business 'triangle' need to be improved and optimised, and a distinction made between long-term public research and the innovative industrial research that most closely meets the national industry policy requirements, which are characterised by different technology readiness levels.

In this light, Italian participation in the ETIP Batterie Europe initiative recently launched by the Commission, and in the European Batteries Alliance (EBA), is a very positive development, looking to 2050, despite the country's limited manufacturing capacity.

On the demand side, innovation in the energy sector, again looking ahead to 2050, will also pass through the use of blockchain and artificial intelligence. The creation of energy trading platforms based on blockchain will allow small energy producers and prosumers to sell excess electricity directly to other network users without the intervention of intermediaries thanks to so-called smart contracts.

In Italy, the development of smart grids will also be a dominant theme over the coming decades. It will benefit not only small producers but also large companies, insofar as the availability of a network in which all devices communicate among themselves will channel a quantity of information able to appropriately predict energy demand to software equipped with artificial intelligence. The increasingly widespread use of these technologies raises, in any case, a series of legal questions which will be an obstacle to full and complete exploitation of the relative potential.

With the growth of digitalisation, the risks connected to this will increase anyway. The field of cybersecurity is one where large spaces and opportunities are opening up for new or innovative players, but the vulnerabilities are also new. Therefore, the cyber research plan in the electricity sector in Italy will also have to address, in the next few years, the issue of innovation of energy infrastructure from a long-term perspective, by means of modelling and simulation activities, experimental activities for verifying preventative and reactive safety measures used in communication systems in the electricity sector.

In this same context, it must be considered that the evolution of the energy mix and of the set-up of the markets will increasingly involve, in an active role, new parties and new resources, at several voltage levels. This creates requirements for research and innovation in technologies to make the system more 'readable' and the networks smarter, and to maintain development of the necessary instruments for safely managing the networks and the energy system.

Lastly it is considered to be of interest to encourage research into the potential benefits of integration of the electricity and gas systems through the development of pilot power-to-gas, power-to-hydrogen and gas-to-power projects; an integration that sees the gas network as a useful tool for development of an ever greater quantity of intermittent renewables, itself a carrier of renewable gases, and – through conversions of electrical energy carriers into gas and vice versa – a pillar of an integrated energy infrastructure, which enables the full potential of renewable sources to be exploited, also guaranteeing the storage of energy in the medium to long-term.

The evolution and development of the technologies previously cited would allow the storage of excess energy produced by non-programmable renewable energy sources (RES) into renewable energy carriers (biomethane, hydrogen, heat) increasing the overall efficiency of the energy system and initiating a synergic course between the two systems towards a possible fusion of the gas and electricity sectors into a single energy sector.

In future, it will be necessary to lay the groundwork for the integration of hydrogen into networks. Especially as produced using electricity from renewables, hydrogen can be obtained using technologies already available on the market and enables the development of innovative storage solutions such as power-to-gas. In addition, the injection of hydrogen

to the network without a specific designated use could help increase the sustainability of the existing networks and exploit the natural gas infrastructure. In the coming years research will need to focus on improving the performance and costs of electrolyzers and on the controlled injection of growing amounts of hydrogen to the gas networks. Solutions envisaging two separate infrastructures (one 100% hydrogen and the other mixed), depending on market maturity levels, are also under study.

As regards the development of a hydrogen supply chain in the road transport sector, the primary need is to invest in research and development and in supply infrastructure. In the rail sector, hydrogen is a valid alternative when there is no electrified infrastructure, to replace diesel locomotives. In the marine sector too, studies and research on the use of hydrogen are under way with the involvement of the main Italian shipbuilding companies, but the development times and amounts of investment required are high.

It will become fundamental to establish a clear and definite legal and regulatory framework for the purpose of promoting the introduction of hydrogen into the current gas infrastructures, as a further source of energy in a mixture with natural gas (including by applying selective hydrogen separation systems, such as membranes). It will also be important to investigate the implications of its introduction into the storage system and in end uses, and provide potential incentives for different technological storage options aimed at developing the production of hydrogen from renewable sources in synergy with the electricity sector and the bioenergy sector, or from zero emissions like methane cracking. Potential investors in power-to-gas plants must have clear and reliable rules regarding the method for calculating the renewable component of the hydrogen produced.

From a research perspective, it will also be important to investigate syngas and sector coupling to achieve greater integration between electricity and gas, and to optimise existing synergies in generation, transport and distribution in the two sectors, with the ultimate aim of creating a hybrid, decarbonised European energy system.

The Ministry of Economic Development has set up a specific working group on hydrogen, which brings together over 70 national stakeholders interested in the development of and applications for this form of energy, in the production, storage and power-to-gas sectors, and in final uses in industry and transport.

iii. Where applicable, national objectives with regard to competitiveness

Italian production of renewable energy systems has decreased significantly in the last few years due to the European crisis and the subsequent period of economic stagnation, aggravated by growing competition from developing countries. Considering the investments that will be made in the coming years to comply with environmental targets, in Italy as in the rest of the world, it is important to define active policies for promoting the technology on offer and research in the energy sector, so as to support manufacturing in Italy.

Current mapping of the technological supply chain for production of systems and components for the systems and their potential in relation to the necessary investments for reaching the new 2030 climate targets solely in a national context offers us an up-to-date picture of the situation.

The renewable energy sector in Italy has experienced a slowdown, due mainly to the adoption of incentivising policies that concentrated growth in the period 2007-2012. This development

represented a boost for component producers located abroad, and not for Italian industry, which has suffered from competition from more competitive markets.

Italy succeeded instead in better grasping the opportunity in relation to manufacturing production of systems for increasing energy efficiency. A possible repeat of the growth trend could have a positive impact on the Italian production of components, provided that opportunities are taken to renew supply and make it more competitive, with a positive effect on the whole supply chain, from producers of raw materials to fitters and to companies for O&M services.

R&D activities in Italy are focused particularly on research into new technological solutions to promote integration of RES into the energy system. The strategic objective is to contribute to the creation of a true renewable energy industrial sector in Italy, which can have a positive impact in economic and occupational terms. From this point of view, it is necessary to improve cooperation with the research system and to establish technological transfer processes and know-how in order to develop technologies in line with company requirements to withstand the challenge of competition from international manufacturers.

The competitiveness challenge that Italy must meet is the development of an integrated industrial research system, with better contact and coordination between research and production, so as to accelerate the introduction of new technologies and products onto the market. The appropriate tools must therefore be implemented to promote Italian production of clean energy plants and investments in R&D must be increased.

Research and development in the technological sector have a global dimension and are not limited to national confines. The increase of funding in research and development provided through participation in Mission Innovation and the refinancing of the Electricity System Research Fund and for interventions and measures for technological and industrial development will certainly have a significant impact on the country, in that it will allow the level of technological innovation in manufacturing system to increase, with a subsequent increase in the level of qualified employment and competitiveness, also thanks to a further reduction in terms of costs for producing energy from renewable sources.

These factors will be able to help with reaching the 2030 and 2050 community targets, and those set out in the Paris Agreement on climate change, at a small overall cost to the system and to public finances. In addition, these investments will allow the use of advanced technologies, able to effectively contribute to the fight against and the adaptation to climate change, and at the same time to increase the competitiveness of the national production system consistent with the priorities of 'Industry 4.0'.

In order to fully seize the opportunities to reinforce the national production structure provided by the investments programme, it will be necessary not only to promote R&D in the field of renewables but also to support the production chain for storage systems and digital architecture and automation linked to network services, given the ever closer links with the renewables supply chain, reinforcing cooperation at a Community level with initiatives such as the EBA, in order to evaluate industrial cooperation projects such as 'Gigafactory' for storage systems.

In fact, an element which is innovative in relation to the past and which will develop increasingly in the coming decades is represented by the digitalisation of the energy sector. The generation of data by the energy system (for example with improvement of technologies and measurement infrastructures, and the demand side management), increase in capacity

for data transmission by telecommunications networks (broadband) and accessibility of an enormous amount of data generated outside the energy system (for example the IoT, the Internet of Things) but also relevant to the sector, means that operators must be able to calculate and analyse (big data) both to improve their own functionality and to offer new services.

While it does not represent energy research in the strict sense, the phenomenon is an indicator of digitalisation, a subject addressed in a systematic manner way in the National Plan for Industry 4.0, which offers a series of support instruments based on company size. National competitiveness objectives could also be pursued by means of this instrument.

The entire circular economy, with geothermal energy, LNG and methane installations, the bioethanol supply chain, the production of electrochemical storage and batteries (not just lithium but also ion and sodium) and of course photovoltaic technologies are therefore the main segments on which to focus, including from the perspective of development in foreign markets.

The measures that Italy intends to adopt with the aim of fostering competitiveness in its industrial supply chains by exploiting the opportunities opened up by the energy transition, especially in terms of research into and the development of new technologies, will be closely monitored periodically and subjected to cost-benefit analyses. In this way, and after discussions with the main production supply chains involved in the transition, with citizens and with the Regions affected, the measures will be updated to take full advantage of the opportunities provided by the energy transition as a driver of sustainable growth following the Green New Deal approach.

3 POLICIES AND MEASURES

3.1 Dimension decarbonisation

3.1.1 GHG emissions and removals

i. Policies and measures to achieve the target set under Regulation (EU) 2018/842 as referred in point 2.1.1 and policies and measures to comply with Regulation (EU) 2018/841, covering all key emitting sectors and sectors for the enhancement of removals, with an outlook to the long-term vision and goal to become a low emission economy and achieving a balance between emissions and removals in accordance with the Paris Agreement

In order to meet the objective of reducing greenhouse gas emissions in the period 2021-2030, equal to -33% in relation to 2005, as provided for by Regulation (EU) 2018/842, Italy will make use of various existing measures as well as new policies which will be introduced.

The sectors responsible for greenhouse gas emissions and removals that fall within the scope of application of Regulation (EU) 2018/842 are transport, housing, the services sector, industry not falling within the emissions trading system (ETS) sector, waste, agriculture and the land use, land use change and forestry (LULUCF) sector.

As regards the policies and the measures aimed at decarbonisation of transport and energy efficiency in the housing sector, services sector and industry not falling within the ETS sector, please refer to the relevant sections of this plan below.

As regards waste, agriculture and the LULUCF sector, the main policies and measures identified for achieving the necessary reductions in greenhouse gas emissions by 2030 are given below.

Circular economy and waste

In general, policies to mitigate climate change have until now been focused on energy efficiency, rather than on the efficiency of materials as a primary driver of improving technical performance. Given the cross-cutting nature of the circular economy, it is necessary to draw up a general strategic plan that identifies specific areas of intervention and the sectors that have the greatest impact. At the same time, the plan must ensure consistency and synergies with other policies planned. Given the specific characteristics of Italy, attention must be paid to the manufacturing, food, textiles, construction and transport sectors.

Recent international studies (<https://www.resourcepanel.org/>) are starting to look more closely at the efficient use of materials and their potential contribution to reducing greenhouse gas emissions. Some studies have identified the following strategies to that end:

- extending the service life of products
- reuse-repair
- opting for less carbon-intensive materials at production stage
- reducing materials used and opting for lighter materials
- improving the production process
- sharing goods
- industrial symbiosis

- recycling and end-of-waste status

By way of example, Ministerial Decree No 62 of 15 May 2019 'Regulation of the end-of-waste status of absorbent hygiene products' sets out the criteria under which various polyolefin-based plastics, super-absorbent polymers and pulp derived from the recovery of absorbent hygiene product waste cease to be classified as waste within the meaning of, and pursuant to, Article 184-*ter* of Legislative Decree No 152 of 3 April 2006. This is an innovative technological process enabling valuable secondary raw materials to be extracted when recycling used absorbent hygiene products, thus cutting out the emissions that would be caused if the products were dumped in landfill or incinerated.

The reduction of emissions in the waste sector is therefore linked primarily to increasing the sorted collection and subsequent recycling of the waste thus collected. In fact, secondary raw materials produced by collecting and transforming waste into new resources allow saving on emissions in a consistent way in relation to the use of raw material. The net gain depends on the kind of material (higher for aluminium and metals) and on the quantities collected.

As regards the organic fraction of sorted collection, the subsequent aerobic/anaerobic processing for compost production enables the transformation into fertiliser rich in organic material of waste that would otherwise be disposed of in landfill, with consequent emission of methane into the atmosphere. Quantitatively speaking, the processing of the organic fraction of urban waste originating from sorted collection has increased from 2.4 Mt in 2007 to 5.9 Mt in 2017. Therefore, in the last ten years, 3.5 Mt of organic waste has been intercepted with sorted collection and processed in order to produce compost, preventing it from being transferred to landfill.

In the future, sorted collection of organic waste is expected to increase. This is partly a result of the new EU-wide obligation to recover such waste, which can be recycled for use in the production of fertilisers. The development of local systems for processing organic waste will also contribute to reducing emissions, by reducing the need to transport the waste over long distances to centralised plants.

In this context, from a quantitative perspective and with due regard for existing legislation, there has been a progressive increase in the number of organic waste processing plants. Here, organic waste is transformed into fertilisers that enrich the soil with organic substances, replacing mineral fertilisers.

The processing of residual fractions of waste that are sent to sorting and stabilisation plants further contributes to reducing emissions into the atmosphere. In relation to 2003 (year of issue of the decree transposing the Landfill Directive), Italy has succeeded in creating capacity for processing of residual fractions, covering almost the total national requirement. In this way, the residual waste is stabilised before being transferred to landfill, reducing the biogas emissions thereof.

Improvement of the overall management of waste in relation to the composition (increase in sorting), and to the quantity of waste disposed of in landfill, following the transposal of European Directive 1999/31/EC on landfill, with Italian Legislative Decree No 36 of 13 January 2003, caused a reduced impact linked to the waste sector. This dynamic may be encouraged by new measures to promote the recycling of organic waste (Italian Prime Ministerial Decree of 7 March 2016) and other waste (End of Waste decrees) consistent with the updating of the relevant legislation.

As regards the future, the approval of the ‘waste package’ will establish the need to further increase national performance in terms of collecting and recycling waste, concurrently reducing the quantities of waste disposed of in landfill. The new legislation that is being prepared for transposition of the ‘waste package’ provides important measures in terms of competences, responsibilities and incentives in order to fully implement the new objectives.

This has resulted in the approval of Decree-Law No 34 of 30 April 2019 (Growth Decree-Law) and Law No 141 of 12 December 2019 transposing Decree-Law No 111 of 14 October 2019. This represents a first step towards promoting the circular economy.

Law No 141 of 12 December 2019 introduced the following measures:

- in order to reduce the production of waste and GHGs, a non-repayable economic contribution of €40 million for 2019-2024 has been allocated for the trial of ‘green corners’ in city shops; here loose or on-draught products are sold, starting with smaller establishments with a view to eventually opening entirely ‘green’ shops;
- to limit the production of plastic waste, an experimental programme called ‘*mangiaplastica*’ is planned. A total of €27 million has been allocated for 2019-2024 to provide municipalities and supermarkets, on demand, with ‘plastic-eating’ machines in which consumers can dispose of their used plastic bottles in exchange for a voucher;
- to launch information, training and awareness-raising campaigns in schools, a specific fund named ‘Io sono Ambiente’ (I am the environment) has been set up, with €6 million allocated for 2020-2022.

The Legislative Decree on Growth has set out provisions on waste and packaging. A business selling a certain commodity can give the buyer a voucher to redeem against the price of future purchases. The discount is equal to 25% of the price of the packaging containing the goods and is granted on return of the packaging in question. The seller re-using the packaging, or sorting it to be sent for recycling, receives a tax credit equal to double the amount granted to the purchaser as a voucher. This credit is granted up to a maximum amount of €10,000 per beneficiary, for a total limit of €10 million for 2020.

In addition, for 2020 the Growth Decree-Law provides for a contribution equal to 25% of the purchase cost of:

- a) semi-finished and finished products which are 75% made up of recycled waste and scrap;
- b) quality compost derived from the processing of sorted organic waste.

If the purchasers are self-employed or businesses and use the commodity for the exercise of their economic and professional activity, the contribution due to them is granted in the form of a tax credit up to a yearly maximum of €10,000 per beneficiary for a total yearly limit of €10 million for 2020. If the purchasers do not use the goods for their economic and professional activity, the limit is €5,000 per beneficiary, with a total limit of €10 million for 2020. In this case, the contribution is paid in advance by the vendor in the form of a discount on the sales price, and then reimbursed to that vendor in the form of a tax credit in the same amount.

Production of electricity

Italy has planned gradual termination of production of electricity with carbon by 2025, with the first significant step by 2023, compensated, in addition to the sharp increase in renewable energy, by a plan for changing infrastructures (to flexible generation, networks and storage systems) to be carried out in the coming years. The implementation of these two processes in parallel is vital to ensure that the result is achieved in safe conditions for the energy system. Despite the limited amount of thermoelectric production from carbon in Italy, in comparison to other European countries (an amount that is however still higher than 30 TWh/year and above the levels of the early 2000s), it is clear that decarbonisation can and must go hand in hand with the safety and cost-effectiveness of supply, exactly in the spirit of this integrated plan.

Initial identification of the infrastructural work necessary has been carried out by Terna (Italian transmission system operator) on the basis of consolidated analysis methodologies and is contained in the National Energy Strategy 2017.

In fact, without prejudice to the need to accelerate growth of renewable energies, in the context of the overall measures (storage, networks, flexible generation, other network operations) to be implemented by the target year 2030, some infrastructure changes are linked in particular to the phasing out of carbon and, in particular, are to be launched in the period 2020-2025:

- new gas capacity for around 3 GW, of which around 50% is substantially linked to the phase-out, in line with regional planning and regulations (on landscape and the environment), and new storage systems for 3 GW in the centre south and south zones, and in Sicily;
- the reinforcement of the transmission network in the Brindisi plant to ensure operational safety (already authorised by the Ministry of Economic Development and by the Ministry of the Environment and in the process of implementation);
- the new line along the Adriatic coast, with transport capacity of at least 1 GW;
- the installation of at least 3000 MVAR of new synchronous condensers, in particular in the south and centre-south zones, to tackle the consequent requirements arising from voltage regulation;
- for the phasing-out of coal in Sardinia, a new electricity interconnection between Sardinia, Sicily and the continent is being looked into, along with new capacity for gas generation or storage capacity of 400 MW located on the island and the installation of condensers for at least 250 MVAR.

For the purposes of energy transition, the new capacity for gas-fuelled generation (with a resulting temporary increase in gas consumption, with no associated infrastructural development envisaged for the time being) will help cover the needs and maintain the adequacy of the system in the next few years. More specifically, taking into account the phase-out of coal-fired power stations, in view of their intrinsic characteristics (potential to respond quickly and for prolonged periods to wide ranges of electrical load), gas-fuelled power stations will ensure the flexibility the system needs, compensating for the significant increase in non-plannable renewable production and ensuring that the system maintains its levels of safety, security, adequacy, resilience and quality of service.

Discussions will be held to assess the infrastructural changes that might be needed in order to phase out coal from electricity production in sectoral working groups (by electricity market zone, by site and one for Sardinia specifically). These will involve operators, local authorities, Terna, the social partners and environmental and trade associations. The aim of the discussion groups is to assess the technical and regulatory conditions, the infrastructure needed, and the ways in which employment can be protected (for which adequate resources have been earmarked).

The network operations are to a large extent already included in the 2018 Terna Development Plan, currently subject to an SEA assessment by the Italian Ministry of the Environment, and in the Terna defence plans. The new capacity for gas production and the storage systems necessary will instead form part of the new investments in support of transition that will be invited through the capacity market, given that in the current situation, the price signals on the spot markets are not capable of sustaining the creation of new investments in a conventional way.

In 2019 the first two tender procedures were held, for the 2022/2023 delivery period, to allow the process of replacing coal-fired capacity or under-performing capacity with new, more efficient and flexible gas capacity.

Considering the average time for authorisation of the Development Plan and the necessary time for planning, authorisation and implementation of the operations, it is necessary to monitor the process, including in terms of the volumes of renewable energy that will be developed in the meantime, and introduce actions for acceleration, so as to have and provide certainty about the time frame of the process. A first verification step may be in place at the end of 2020, the date on which the authorisation proceedings, for the principal works at least, will need to have been concluded.

Considering the importance, including from a territorial and social perspective, of this change, the Italian government and the Ministry of Economic Development in particular intend to engage in a dialogue with the relevant operators and with the workers' associations and representatives of regional and local bodies, also evaluating possible site developments, again for energy purposes and related supporting activities.

Agriculture

Agriculture and animal husbandry represent significant sources of greenhouse gas production, consisting primarily of methane, ammonia and nitrous oxide.

Ammonia emissions are determined principally by the management of animal waste and by the use of fertilisers.

Emissions of nitrous oxides originate from the nitrification and partial denitrification reactions of the ammonia present in the animal waste, from the storage of manure, from the use of fertilisers, from the cultivation of organic soils, from agricultural management residues and from the microaerophile conditions typical of permanent dunging areas.

Methane emissions are caused by the management of animal waste, biomass combustion, rice cultivation, enteric (ruminal) fermentation and by fermentation due to organic substances which are not digested and then excreted as waste.

At a sector level, in the case of animal husbandry, effluent management (bovine, pig and poultry) is the business phase in which 50% of total agricultural emissions are generated.

More specifically, in the field of animal husbandry, ammonia emissions are generated by the microbial fermentation undergone by the nitrogen present in the animal waste (faeces and urine) and which happens in all stages of management, from the moment of excretion in the barn up until the distribution in the field. In the agricultural sector, however, ammonia emissions are generated by the use of organic and synthetic fertilisers.

Regarding the agricultural and animal husbandry sectors, the following actions have been identified:

- **Programme Agreement for coordinated and joint adoption of measures to improve air quality in the Po basin**

The Po Basin Agreement 2017 identifies joint measures and actions to combat emissions, including greenhouse emissions and fine particles. Regarding measures in the agricultural and animal husbandry sectors, the Italian Regions must, as part of the air quality plans, apply practices aimed at the reduction of emissions produced by agricultural activity, including coverage of structures for storing sewage, using the correct methods for spreading of manure and the burial of soil surfaces used to apply fertilisers, where these practices are technically feasible and economically sustainable.

For biogas of agricultural origin, consideration must be given to the system for managing animal-husbandry waste liquids, and the end-use of digestate. This is especially important in areas which are vulnerable to nitrates and are affected by air-quality problems caused by the build-up of secondary pollutants deriving from the recombination of ammonia released mainly into the atmosphere by agriculture.

- **National code indicative of good agricultural practices for controlling ammonia emissions**

The code, which will become part of the national programme for controlling atmospheric pollution, takes account of the following factors for reducing ammonia emissions:

- nitrogen management, taking into account the whole nitrogen cycle;
- livestock feeding strategies;
- low-emission manure storage and spreading techniques;
- low-emission animal housing systems;
- possibilities for limiting ammonia emissions from the use of mineral fertilisers.

The code provides mandatory measures for mitigating and reducing ammonia by means of: different use of fertilisers; techniques for spreading manure and storage. The optional mitigation measures are to be financed using European funding attributable to rural development policies.

- **Common Agricultural Policy (CAP) 2021 - 2027**

The measures indicated in the aforementioned national code are reflected in terms of both budget and application in the instruments of the Common Agricultural Policy (CAP), which, in comparison to the 2014-2020 CAP, places greater focus on improving the environment. These measures will be viable in the period 2021-2027 and provide for:

- reinforcement of the cross-compliance that will involve direct payments subject to more rigorous environmental requirements;
- the obligation of Member States to introduce ecological regimes that have a positive impact on climate and the environment, but the use of which is optional for individual

agricultural companies, in the first pillar (direct income support for farmers and market measures);

- payments for environmental and climate-related undertakings, and other undertakings relating to management, in the second pillar (rural development).

- **Promotion of CO₂ sequestration measures in agricultural soils and forest systems**

With due consideration for the outcome of the public consultation, an assessment will be made of potential measures to promote initiatives aimed at CO₂ sequestration in agricultural soils and forest systems (soils, subterranean and above-ground biomass, wood, etc.). This will also take into account potential payment measures for ecosystem services for forestry and those linked to agricultural soils and to herbaceous (arable, etc.) and arboreal farming systems.

LULUCF

As regards the forestry sector, the following actions have been identified:

- **Preparation of the Annual Report on Italian Forests**

The report foresees consolidation of up-to-date understanding of Italian forests in every aspect: natural, productive, economic, etc. Collection of information from all of the stakeholders involved is also envisaged, including the Regions, regional bodies, ISTAT, and the economic and scientific sector.

- **Consolidated Law on Forests and Forest Supply Chains**

On 3 April 2018, the new Italian Consolidated Law in relation to forests and forest supply chains (TUFF) was enacted, with Legislative Decree 34/2018, which repeals Legislative Decree 227/2001, 'direction and modernisation of the forestry sector'. The TUFF provides advice and guidelines to support regional administrations in relation to forestry management. The TUFF updates the coordination arrangements and the national guidelines in relation to Sustainable Forestry Management and development of forestry supply chains. In order to create a concrete and uniform national forestry policy, nine implementing decrees are envisaged to identify minimum criteria and guidelines for the sector, including, for example, training of workers, entering competent companies onto a register, recognising the status of the forests as abandoned cultivated land, guidelines for management and forestry planning. With this measure, the goal is to recognise Sustainable Forestry Management as a tool aimed at ensuring an increase in carbon absorption, including in the production of quality timber products. In this context, over a period of ten years, a progressive change of the utilisation rates recorded thus far is envisaged, increasing from the current 30-33% to a possible 40-45%.

- **White paper on the forests of Italy**

In order to support the process of drafting a new national forestry strategy, the white paper on the forests of Italy has been published and is open for consultation, with the aim of providing support to the establishment of the new National Forestry Strategy (NFS). The white paper collects and summarises the views, requirements and needs of civil and business society and the scientific and institutional world on the role of the forestry sector. The goal is to contribute to making the new NFS consistent and effective in fulfilling the needs of the

forestry sector, consistent with European recommendations and international commitments in relation to mitigation of and adapting to climate change, in order to guarantee stability and well-being for present and future generations.

Cross-cutting instruments and other measures

Other than those established on a sectoral level, further policies and measures that contribute to ESR objectives are listed below:

- **Transposition of Regulation (EU) No 2016/2284**

Italian Legislative Decree No 81/2018, transposing Directive (EU) No 2016/2284, provides for the reduction of certain atmospheric pollutants (sulphur dioxide, nitrogen oxides, non-methane volatile organic compounds, ammonia and fine particulate matter) by means of:

- the drawing up, adopting and implementing of national air pollution control programmes in conjunction with policies adopted in relation to climate change;
- the creation of a national emissions inventory and national emission projections;
- monitoring of emissions not subject to a requirement for reduction;
- monitoring of the impacts on ecosystems.

- **Italian Ministerial Decree No 186 of 7 November 2017: 'Rules governing the requirements, procedures and responsibilities for issuing a certificate for heat generators powered by solid biomass fuel'**

The Decree establishes the requirements, procedures and responsibilities for issuing an environmental certificate for heat generators powered by firewood, charcoal and combustible biomass. The Decree identifies, additionally, the emission performance standards for different quality classes, the related test methods and checks to be carried out for the purposes of issuing the environmental certification, and specific obligations relating to guidance to be provided about the correct methods of installation and management of heat generators which have obtained the environmental certificate.

- **Implementation of Regulation (EU) No 517/2014**

In order to reduce emissions of fluorinated greenhouse gases that occur during operations for the installation, maintenance, repair and dismantling of equipment that contain these gases, the new Italian Presidential Decree adopted in November 2018 provides for the adaptation of the certification system for natural persons and for companies that carry out these operations, and the establishment of a 'database' for the collection and retention of information relating to sales of fluorinated greenhouse gases and of equipment containing these gases, as well as all of the registrations relating to operations for the installation, maintenance, repair and dismantling of such equipment.

- **Environmental Code**

The Environmental Code represents a tool, already active today on a national level, which contributes to reducing greenhouse gas emissions by means of:

- a) implementation of procedures for Strategic Environmental Assessment (SEA), for Environmental Impact Assessment (EIA) and for Integrated Environmental Authorisation (IPPC);
- b) providing of soil conservation measures and combating desertification, protecting

water from pollutants and digestion of water resources;

- c) management of waste and remediation of contaminated sites;
- d) air pollution prevention and reduction of emissions into the atmosphere;
- e) compensation for environmental damage.

- **Fund for energy transition in the industrial sector**

Decree-Law No 101 of 3 September 2019 established the ‘Fund for energy transition in the industrial sector’ to support energy transition in sectors or sub-sectors that are considered to be at a high risk of re-localisation of carbon emissions owing to costs linked to greenhouse gas emissions being transferred onto the price of electricity. The fund is constituted by that part of the annual revenue deriving from EU ETS auctions that exceeds 1,000 million. This excess amount, up to a maximum of €100 million per year for 2020 and €150 million as of 2021, will be used to fund decarbonisation and energy efficiency measures in the industrial sector.

Possible effects of the plan on air quality

The need to link decarbonisation and air quality improvement objectives and measures is explicitly provided for in the Governance Regulation. In this context, at national level Legislative Decree No 81 of 30 May 2018, transposing Directive 2016/2284, provides for the implementation of the National Plan for Air Pollution Control (NPAPC). The Plan must be drawn up by the Ministry of the Environment, with the support of ISPRA and ENEA, to produce scenarios for the expected situation in 2020 and 2030 in terms of emissions and air quality.

The NPAPC was drawn up in line with the instructions contained in Directive 2016/2284 (Annex III, Part 1) and sent, in draft version, to the European Commission within the deadline indicated.

In accordance with the laws in force, in drafting the INECP and the NPAPC the competent Ministries aimed to ensure consistency in terms of the analytical basis and the packages of measures, in line with the various timelines envisaged for the two plans. In concrete terms, the NPAPC adopts hypotheses on consumption and levels of production that are in line with the energy and the environment scenarios envisaged in the INECP.

Consequently, in addition their impact on climate-changing emissions, the measures considered in the NPAPC guarantee significant reductions in the pollutants targeted by the Plan, namely nitric oxide, sulphur dioxide, particulate air pollution and non-methane volatile organic compounds. As regards ammonia, further measures have been drawn from the code of good agricultural practice drawn up by the Ministry of Agricultural, Food and Forestry Policy (for more details see Tables 11, 12, 13 and 14 of Chapter 8 of the NPAPC).

Using this ‘INECP-harmonised’ framework as a starting point, emissions scenarios for 2020 and 2030, shown below in table form, have been produced for all of the pollutants mentioned (Chapter 6 of the NPAPC). As can be seen, the implementation of the measures in the plan will result in compliance with all the reduction targets set out in the National Emission Ceilings (NEC) Directive.

Table 25: Reduction in emissions by 2020

	NEC Directive target by 2020	2020 scenario no measures	2020 scenario with NPAPC measures
SO₂	-35%	-61%	-70%
NO_x	-40%	-43%	-47%
PM2.5	-10%	-17%	-23%
NMVOC	-35%	-35%	-41%
NH₃	-5%	-7%	-8%

Table 26: Reduction in emissions by 2030

	NEC Directive target by 2030	2030 scenario no measures	2030 scenario with NPAPC measures
SO₂	-71%	-73%	-80%
NO_x	-65%	-63%	-70%
PM2.5	-40%	-33%	-42%
NMVOC	-46%	-43%	-50%
NH₃	-16%	-11%	-17%

The integrated policies for decarbonisation and air-quality improvement were recently supplemented by two other provisions.

In June 2019 the ‘Action plan for improving air quality’ was launched. Signed by the Prime Minister’s Office, six Ministries, and the Regions and Autonomous Provinces, the plan contains measures on transport, agriculture and biomass-fuelled domestic heating, the sectors most responsible for the current high levels of pollution.

The plan covers two years and contains measures targeting both air quality and decarbonisation. These measures are broken down into five areas, four thematic and one cross-cutting:

- Agriculture, with measures for reducing ammonia emissions and limiting the burning of plant residues. Specifically:
 - ✓ in the framework of future rural development programmes, forms of funding will be linked to ammonia emissions reduction, in order to guarantee, for the 2021-2027 programming period, an increased use of such measures among farmers, with a concurrent reduction in polluting emissions;
 - ✓ amendment of Legislative Decree No 152/2006, which is intended to limit the practice of burning plant residues, also with a view to recovering and utilising those residues.
- Mobility, with the introduction of environmental criteria for non-urban traffic, limited to sections of motorway adjacent to urban centres and within the scope of limited traffic

zones, with disincentives for the use of highly polluting vehicles. Specifically:

- ✓ proposed amendment of Legislative Decree No 285 of 30 April 1992, designed to introduce environmental criteria for the adoption of traffic reduction provisions, limited to sections of motorway adjacent to urban centres and with particular reference to speed limits;
- ✓ proposed amendment of the existing legislation in order to explicitly provide for the possibility of using devices to monitor limited traffic zones, including within those areas and not only at 'gateway' points;
- ✓ adoption of guidelines for classifying hybrid electric vehicles in order to allow national and regional authorities, as part of incentives programmes, to channel those incentives towards hybrid electrical technology with a lower environmental impact;
- ✓ adoption of a decree authorising the experimental circulation of largely electric-powered personal mobility vehicles, such as Segways, hoverboards and scooters, in cities.
- ✓ introduction of bonus/malus criteria to disincentivise the use of highly polluting vehicles;
- ✓ publication on the institutional website of guidelines and good practices to promote active mobility, especially for home-to-school or home-to-work routes, including by the Regions.
- Domestic heating, with measures to reduce polluting emissions from biomass-fuelled stoves and heaters and to limit the use of gasoil-fired heaters, and to promote the training of installers of renewable energy-fuelled heaters.

Regarding the measures designed to reduce pollution from biomass fuel, the following specific measures are envisaged.

- ✓ Updates to the sectoral legislation to make incentives to replace heaters fuelled by firewood, briquettes and wood chips conditional upon the certification of such solid biofuels, by the relevant bodies, as complying with the relevant technical standards (ISO UNI EN 17225 parts 3, 4 and 5). Also, compliance with appropriate forms of traceability and environmental sustainability criteria to ensure, energy production being equal, a reduction in the emission of pollutants and carbon dioxide;
- ✓ Analysis of potential limits to the use of biomass for district heating plants in areas particularly affected by air pollution.
- Phase-out of coal, envisaged by 2025 in Italy, with an acceleration for thermoelectric power plants in areas subject to infringement proceedings, by closing or transforming them.
- Cross-cutting measures such as the reduction of environmentally damaging subsidies. In this context, and with reference to the planned phase-out of coal, the Budget Law for 2020 revises and increases the levies on energy products used to produce electricity. The sole aim of this measure is to introduce specific rates of excise duties determined on the basis of levels of emissions of greenhouse gases and fine particles. The increase, which applies to all fossil fuels, is particularly high for coal, coke and lignite. The exemption envisaged for non-chemically modified vegetable oils remains in place.

The second provision for the implementation of the national strategic plan for combatting climate change and improving air quality is Law No 141 of 12 December 2019, converting Decree-Law No 111 of 14 October 2019, known as the 'Climate Decree'.

The Decree provides for the creation of a national strategic plan identifying urgent measures to combat climate change and correctly and fully implement Directive 2008/50/EC. In line

with the European ‘Green New Deal’, this new planning approach targets both climate change and air pollution in parallel, with the aim of fostering maximum synergy between the two sectors.

In addition, to monitor the steps taken as part of the national strategic plan and adjust them according to the results, the Decree establishes a permanent interministerial working group on the climate crisis at the Ministry of the Environment and Protection of Natural Resources and the Sea. The group is made up of one representative from the Ministry itself and one each from the Ministry of Agricultural and Forestry Policy, the Ministry of Health, the Ministry of Economic Development and the Ministry of Infrastructure and Transport.

The Decree identifies actions in the sustainable mobility and reforestation sectors, setting up special funds to provide the resources necessary to implement them. The measures identified include the following.

- Incentives for sustainable mobility in metropolitan areas, setting up a special fund called the ‘Experimental Mobility Voucher Programme’, with an allocation of €5 million for 2019, €70 million for 2020, €70 million for 2021, €55 million for 2022, €45 million for 2023 and €10 million for 2024.
- establishing a ‘Mobility Voucher’ for residents of the municipalities subject to EU infringement proceedings No 2147/2014 of 10 July 2014 and No 2043/2015 of 28 May 2015 for non-compliance of Italy with the obligations set out in Directive 2008/50/EC, who take for scrapping, by 31 December 2021, type-approved passenger vehicles up to Euro Class 3, or type-approved motorcycles up to Euro Class 2 and Euro Class 3 two-stroke motorcycles;
- establishing, within the above-mentioned spending limits and until resources have been used up, a ‘Mobility Voucher’ of €1,500 per passenger vehicle and €500 per motorcycle scrapped. The voucher is to be used, within the following three years, to buy season tickets for local and regional public transport or bicycles, including e-bikes;
- funding for projects creating, extending, modernising or bringing up to standard preferential lanes for local public transport (LPT), with an allocation of €20 million to be authorised for each of the years 2020 and 2021;
- introducing measures to promote ‘Sustainable school transport’, with €10 million earmarked for each of the years 2020 and 2021 to fund experimental programmes to set up and run a school transport service for children attending state and municipal infant schools and for pupils in their first cycle of state school, using hybrid or electric means of transport, selected by the Ministry of the Environment on the basis of the number of students involved and the estimated reduction in air pollution;
- reforestation measures, with a grant of €15 million for each of the years 2020 and 2021 for an experimental programme for tree planting, replanting and forestry and the creation of urban and suburban forests in metropolitan cities;
- establishing Economic Environmental Zones (ZEAs) in areas within national parks. In such areas forms of support can be set up, in compliance with EU rules on State aid, for new and existing businesses that launch a programme of economic or investment activity aimed in particular at reducing greenhouse gas emissions and promoting renewable energy and energy efficiency. The Budget Law for 2020 (Law No 160 of 27 December 2019) includes in the statement of estimates of the Ministry of Economic Affairs and Finance a fund with an allocation of:

- €470 million for 2020;
- €930 million for 2021;
- €1,420 million for each of the years 2022 and 2023

of which a quota of at least €150 million for each of the years 2020, 2021 and 2022 is intended for initiatives to reduce greenhouse gas emissions, develop renewable energy and energy efficiency, combat deforestation, and promote the geological capture of CO₂ and sustainable mobility. From the fund, €20 million for 2020, 2021 and 2022 is destined for initiatives in the ZEAs. The fund includes revenues from the auctioning of CO₂ emissions allowances.

- Setting up the 'Green Italy' programme to encourage initiatives for the sustainable management of Italian cities and the spreading of good practices. To this end, each provincial capital can submit to the Ministry of the Environment and Protection of Natural Resources and the Sea an application detailing projects to increase urban sustainability, improve air quality and public health, and promote sustainable mobility and the circular economy, on which work could be started at once. The projects included in the bid dossier of the city awarded the title 'Green Capital of Italy' are financed by the Ministry of the Environment and Protection of Natural Resources and the Sea in the year in which the award is made, with a ceiling of €3 million. The title 'Green Capital of Italy' in the award year is a condition for all notices and tenders for environmental sustainability funding launched by the Ministry of the Environment and Protection of Natural Resources and the Sea.
- Planned transformation of the current Interministerial Committee for Economic Planning (CIPE) into the Interministerial Committee for Sustainable Development (CIPESS), within a year and a half. One aim is to carry out, in line with the Green New Deal, an extensive revision of the structure of State economic planning. Another is to redefine upstream the sustainability criteria on which economic choices and the selection of public works and infrastructure are based.

ii. Where relevant, regional cooperation in this area

With the regions with which Italy has embarked on a process of regional cooperation, the discussion will be based primarily on the exchange of best practices for adopted or planned policies.

iii. Without prejudice to the applicability of State aid rules, financing measures, including Union support and the use of Union funds, in this area at national level, where applicable

3.1.2 Renewables

i. Policies and measures for making the national contribution to achieving the binding targets on an EU level for 2030 in relation to renewable energy and trajectories, pursuant to Article 4(a)(2), where applicable or available, the elements given under point 2.1.2 of this annex, including specific measures by sector and by technology¹¹

¹¹ When planning those measures, Member States must take into account the end of life of existing plants and the potential for repowering

The list of principal measures aimed at realising objectives relating to renewable energy, divided into the electricity, heating and transport sectors, is set out below.

Electricity sector

The measures for the electricity sector will be focused on supporting the construction of new plants and safeguarding and improving the sites of existing plants. The measures are of an economic, regulatory, planning, IT and administrative nature, and are calibrated on the basis of the type of intervention (new construction or reconstruction), the size of the plants and the state of technological development.

At the moment, offshore wind farming, thermodynamic solar power, geothermal energy with reduced environmental impact and marine energy are considered innovative; onshore wind farming, solar photovoltaics, hydroelectricity and sewage treatment plant gas are considered to be older technologies. Among the older technologies are biomass and biogas, which nevertheless still involve high production costs, primarily due to the costs of raw materials. In addition, for biomass, the considerations discussed in chapter 2 concerning targets must also be taken into account.

Energy plants for individual and collective self-consumption: regulatory and economic measures

The rules governing the collection of general system charges and electricity tariffs, introduced in 2018 as part of the plan for adaptation to EU guidelines on State aid for energy and the environment, provide, in themselves, a regulatory framework that favours instantaneous self-consumption. The collection tariff structure provides for the application of variable proportions of the tariff (€/MWh) to energy taken from public networks. For collective self-consumption, especially in cases where the use of existing public networks is preferred, the possibility of introducing direct forms of support is currently being examined. In this, due regard is being given to the benefits linked to distributed generation in terms, for instance, of decreased use of the network. In any case, the direct and indirect costs of promoting new systems of self-consumption, including collective consumption and renewable energy communities, will be monitored, keeping the equilibrium of the system under control. The aim is to strike a balance between the promotion of self-consumption and equal participation of electricity customers in covering these charges, which should show a tendency to decrease, particularly from the middle of the next decade.

Work will also be carried out on development of the net metering mechanism (which enables the use of the network as a storage system), to promote rewards for plants on the basis of their quota of self-consumed energy, which can also be increased by installing accumulation systems, and for plants which go on to provide services to ensure the safety of the electricity system on medium- and low-voltage networks.

In all cases, promotion of individual self-consumption will be aimed primarily at distribution plants for which, moreover, the simplicity and automated nature of the support mechanisms make them preferable to other tools which are more complex and expensive to manage.

Further instruments to support self-consumption, both individual and collective, will be:

- reinforcing minimum quota obligations for renewable energy sources in new buildings or buildings subject to major renovation, in line with the targets for near-zero emissions buildings;

- progressive and gradual extension of the minimum quota obligation for renewable energy sources (which, as mentioned, is currently envisaged only for new buildings or buildings subject to major renovation) to existing buildings, starting with several categories such as warehouses used for manufacturing activities and service sector buildings. As an alternative to construction of plants, methods will be assessed for transferring rights to roof surfaces to third parties, with a renewable installation preferably for the service of the building.

These last two points are also linked to similar measures relating to thermal renewables, detailed in the relevant section.

On a preliminary basis, it is expected that the promotion of self-consumption by way of the above measures could lead to an increase in the consumption of renewable energy equal to at least 1 TWh each year.

Other measures for small-scale energy plants

Other than the promotion of self-consumption in the terms outlined above, which in itself constitutes an important incentive for the construction of small-scale energy plants, further measures will be introduced both to facilitate self-consumption where possible, and to promote construction of small-scale energy plants, which enable production in the electricity network where self-consumption is not technically and economically viable, and, lastly, to facilitate achieving the other targets considered relevant at the same time. The intended measures are as follows.

- To introduce simplified and homogeneous procedures for the construction, commissioning and management of plants, including expanding the scope of the uniform model, currently operative for certain photovoltaic installations with power up to 20 kW: it involves a mechanism which allows, with a single procedure, management of features relating to authorisation, network connection and accessing support mechanisms. These procedures, aimed both at new RES plants and at the reconstruction of existing ones, can also be extended to small-scale storage systems, as well as plants connected to existing points of delivery (PODs) whose contracted demand is greater than the power of the plant.
- In line with the outcome of the public consultation, there are plans to extend the use of the Simplified Authorisation Procedure (SAP), which today can be used for individual plants with power between a few dozen and several hundreds of kW;
- To promote the installation of photovoltaic plants in existing agricultural structures that do not fall within the definition of a building, including by introducing the concept of 'rural building' to facilitate access to support measures.
- to permit the aggregation of small-scale energy plants to enable participation in procedures for accessing incentives for energy delivered to the grid (see the section on contracts for difference);
- establish specific incentivising tariffs, for cases in which self-consumption is not viable, and provided that there is significant accessible potential and prospects for containing costs and the incentives themselves; combined heat and power generation from waste and residues from the Agri-industrial sector is of interest, in particular by means of plants forming part of the production cycle of companies. These allow, in line with the principles of the circular economy, the waste itself to be utilised and production cycles to be optimised, with smaller shares of raw materials in the secondary collection (in the case of biogas plants, advantages may be additionally gained in terms of use of digestate, found in areas vulnerable

to nitrates);

- introduce rewards for construction of photovoltaic plants where the modules are installed as replacements for roofing containing asbestos.

The first operational tool for incentivising small-scale (and other) plants was established by the Decree of 4 July 2019, the effects of which will be seen in the first part of the 2012-30 ten-year period, in particular with respect to meeting the first interim target of the series of objectives on renewables. A summary of the Decree is included in the section on large-scale plants.

Renewable energy communities

To avoid inefficiencies in the development of the network, renewable energy communities will be promoted primarily by utilising the existing electricity network. They will help support the economies of the smaller regions, often rich in renewable resources, and will also make it possible to produce and consume renewable energy locally, including in situations where self-consumption is technically difficult. Renewable energy communities will be able to play an important role in terms of reaching local consensus on the authorisation and building of energy plants and infrastructure.

In addition, given their aims as set out in the Renewable Energy Directive, ways in which those communities can also provide support to families in conditions of energy poverty, especially where direct interventions (for example, self-consumption plants) are not technically feasible, will be explored.

Renewable energy communities will be promoted in economic terms by means of direct support mechanisms for production, including by more than one plant (similarly to the general production support mechanisms) and for locally consumed energy. The benefits to be reaped in terms of network use in this last case will be taken into account, with due regard to the rights and obligations of the members of the community as customers. These set-ups will have privileged access to support mechanisms.

Renewable energy communities will also be promoted through information on locally available resources (also making use of the procedure for identifying suitable local areas, as mentioned below) and on the opportunities offered by support mechanisms. The development of standard tools for setting up and managing the communities and for exploiting energy production will be assessed. Given that in Italy the first local trials have already been launched on the initiative of certain Regions and municipalities, these experiences will be reviewed and monitored within the framework of the INECP Observatory to assess the possibility of developing facilitation and support measures. In those local areas where it is possible and appropriate, the use by those communities of thermal energy from renewables will be promoted.

In the context of the transposition of the Renewable Energy Directive and in line with the transposition of the Electricity Market Directive, special attention will be paid to the relationships between renewable energy communities and citizens' energy communities. These groups appear to have the possibility, in addition to producing, storing and consuming energy from renewable sources, of providing other services such as energy-efficiency services and electric vehicle recharging services.

This last aspect will be examined to assess the potential of promoting forms of aggregation and cooperation in the production and consumption of renewable energy, as well as in the provision of energy-related services, including in the context of production clusters.

Large-scale energy plants (typically with power above 1MW): regulatory and economic measures

- **Contracts for difference to be established following competitive tenders**

We will continue to employ the mechanisms of competitive tender, which have already been trialled, adopting a neutral approach among groups of technologies with similar structure and levels of cost, possibly with safeguarding mechanisms where technologies deemed necessary to reach targets in any event are repeatedly unsuccessful, it being understood that one of the aims of this mechanism is to support market parity. The tenders will be for the purpose of entering into contracts for difference based on the overall value of the recognised tariff once the procedure has been carried out, according to the ‘two way’ criteria (namely recognition of the difference between the tariff and the market price of electricity where the difference is positive; repayment on the part of the producer if the difference is negative). This mechanism seems to be suited to pursuing the targets set, in that it enables pre-defined power levels to be programmed, providing certainty to operators and, at the same time, potential advantages also for consumers, where the market price of electricity goes above the recognised tariffs, a not unlikely circumstance if you consider that the 2016 tender procedures carried out for wind power were awarded at €66/MWh and lower values have been recorded in other European countries.

This mechanism will be the principle tool for promoting the construction of new plants but could also be considered for supporting full renovations and improvements to existing plants, in cases where long-term contracts and administrative simplifications prove to be insufficient.

In line with those intentions, in 2019 Ministerial Decree 4/7/2019 (RES1) was published, providing an incentive for almost 8GW (of which 7.4GW new) for renewable energy plants with a high level of technological maturity. The quotas are allocated by means of competitive procedures (tenders and registers, depending on the size) in six rounds up until 2021. The plants built are expected to contribute substantially to meeting the first of the renewable energy objectives. Competition between groups of technologies with similar cost structures is envisaged. The new wind and photovoltaic plants (to which the biggest quotas will be allocated) thus constitute a single group, in which the two types of plant compete on the basis of economic criteria only (for power equal to or greater than 1 MW) or environmental and economic criteria (for power of less than 1 MW). The same applies to the other group, in which hydroelectric plants and sewage gas plants compete in the same way, albeit with technological safeguards. For registered plants (lower than 1 MW) solutions with high environmental value are given precedence, such as one specific quota for photovoltaic rooftops replacing roofs containing asbestos, or installation in areas of low environmental value, such as closed and restored landfill sites. Installations coupled with charging points are also favoured, thus giving an extra push to electric mobility and smart and vehicle-to-grid charging systems. Where self-consumed energy exceeds 40% of production, a specific bonus is provided for, which also encourages the proliferation of energy storage systems. The aggregation of plants via specific priority criteria will also be favoured. Users can opt for all-inclusive tariffs, up to 250 kW.

For plants with power equal to or greater than 1 MW, only the economic criterion applies, as mentioned above: the tariff recognised once the tender procedure has been completed will be based on difference, according to the ‘two way’ criteria explained above. The Decree therefore represents the first concrete application of the criteria described above. The sufficiently high level of participation in the first tender and register procedure suggests that the tool could be a fundamental means of ensuring that electricity renewables play a part in meeting the objectives. This is of course subject to it being properly monitored and, if necessary – on the basis of experience gained – improved and simplified, along with any necessary simplification of the authorisation procedures (which also ensure the right level of liquidity and competition in the procedures).

Long-term contracts (PPAs)

Italy intends to widely promote use of this tool, alongside contracts for difference, with regulations that encourage investors to enter into Power Purchase Agreements (PPAs) with parties interested in purchasing the energy that the plant will produce over a period of time long enough to guarantee the return on the investment necessary to construct a production plant, or to renovate or improve an existing plant. The Ministerial Decree of 4 July 2019 provides that a regulatory framework for the creation of a market platform for long-term trading be set up within 180 days of its entry into force. For this purpose, a study has already been launched with the aim of investigating the legal, regulatory and technical framework surrounding widespread use of PPAs. The need for the study comes from the fact that renewable sources with better residual potential (solar and wind power) are now able to be used at sufficiently low cost.

In any case, for these sources the energy production cost is ascribable to a large extent to the initial investment and not to the costs of the operation, as with traditional plants, where it is still based on the current structure of the electricity market. On the basis of the study, a reference nomenclature is to be developed, defining the possible kinds of PPA and the relative minimum requirements for entering into the contracts, with examination of the requirements of the different parties involved (large-scale consumers, traders, aggregators, producers, funders), and identifying possible barriers to be removed, of a legislative or regulatory nature. The ultimate aim is to promote the use of these contractual schemes without them resulting in charges for the State or for consumers.

In the first phase, the possibility will be considered that the State could provide an ‘initial push’, by means of pilot projects as part of the National Action Plan for Green Public Procurement and procurement procedures for energy supply through tenders run by Consip, a state-owned company whose mission is to make the use of public resources more efficient and transparent, providing tools and skills to public administration to allow them to perform their own purchases and to stimulate a competitive participation of enterprises in public tenders.

At the same time, the aim is to promote dialogue between the parties. First, by recognising production plant projects promoting the aggregation of potential demand, in particular from small and medium-sized companies. And second, by promoting the participation of potential power demand aggregators, in particular small and medium-sized enterprises and purchaser groups/consortiums representing end-customers, in line with the outcome of the INECP public consultation. The aggregation of supply from energy producers, including those using different technologies, will also be promoted.

As mentioned above, the Ministerial Decree of 4 July 2019 will contribute to the development of PPAs. The Decree stipulates, in fact, that GME (the Italian energy market operator) must regulatory framework for the creation of a market platform for long-term trading. The aim is to promote the trading of production by newly-constructed renewable energy plants, either entirely reconstructed or reactivated, upgraded or refurbished, which started operating after 1 January 2017 and have not benefitted from energy production incentives. Non-economic forms of support are provided for, such as the classification of the plants (by GSE), the removal (by the ARERA) of any regulatory barriers, as well as an update of the guarantee of origin regulations, to enable its direct cancellation by end-users.

The Ministerial Decree of 4 July 2019 provides that a regulatory framework for the creation of a market platform for long-term trading be set up within 180 days of its entry into force. For this purpose, a study has already been launched with the aim of investigating the legal, regulatory and technical framework surrounding widespread use of PPAs. The need for the study comes from the fact that renewable sources with better residual potential (solar and wind power) are now able to be used at sufficiently low cost.

On a preliminary basis, PPAs are expected to contribute at least an additional 0.5 TWh each year of renewable energy.

Common measures for large- and small-scale energy plants

The scope of the renewables targets, along with the fact that increases in electricity production are expected predominantly from wind and photovoltaic sources, means that significant surface area on which to install such plants is needed. This consequently requires that the Regions be closely involved through, for example, the public debate mechanism, as is already the case for large-scale investments, including in the energy field. This, along with renewable energy communities, will raise awareness in the local communities involved, by informing and involving citizens and local authorities sufficiently ahead of final decisions affecting local areas. In addition to this awareness raising, crowdfunding measures and environmental compensation measures could contribute to acceptance. In any case, support mechanisms must help guide location choices, by prioritising installations with reduced environmental impact, such as in buildings and areas not suitable for other uses.

As the results of the INECP public consultation also showed, stakeholders feel it is necessary to ensure the uniformity and certainty of the time frame of the authorisation process, which also needs simplifying. Closer collaboration between the State and the Regions should also be promoted, including by adopting a standardised format for issuing authorisations at national level, making the time frames, methods and procedures the same.

For large wind plants in particular, operators will be encouraged to carry out careful preliminary assessments involving local communities and economies, with adequate priority given to upgrading and renewing obsolete plants.

To meet these needs, the following measures will also be taken.

- **Sharing objectives with the Regions and Identifying areas suitable for plant construction**

The renewables targets, especially in the electricity sector, will be met chiefly through wind and photovoltaic energy. Adequate land surface will therefore be needed. While in the photovoltaic sector existing buildings and compromised areas not suitable for other uses will

be exploited, national objectives will be shared and agreed with the Regions under a national regulatory framework. This, in line with the need to protect agricultural and forested areas, cultural and landscape assets, and the quality of air and bodies of water, will set out criteria (again agreed with the Regions) on the basis of which the Regions themselves will be able to identify the areas that are suitable for installing renewable energy plants and those which are not.

In this context, proper consideration will be given to relocating existing plants, the availability of renewable primary resources, shifts in demand, and the constraints and potential development of the network.

The potential availability of renewable primary resources, shifts in demand, constraints on and development potential of the network and potential back-up sources will need to be taken into account. To achieve these aims, a computerised and interactive survey will be carried out on 'already constructed' and other areas suitable for energy production and not suitable for other uses (without prejudice to the criteria referred to above). This will make it possible to assess their energy capability. The identification of these areas will also feed into the coordinated development of plants, electricity networks and storage systems, with authorisation procedures made simpler and quicker (and coordinated with support mechanisms), given that information on the suitability of surfaces and areas will already have been shared and agreed on.

- **Ad hoc instruments for new plants based on innovative technologies**

For technologies which are still far from being economically competitive in Italy, or which have significant potential for innovation, procedures based on their specific characteristics will be implemented. The use of tariff instruments will be assessed by taking into account the state of development, the capacity for cost reduction, the exploitable potential, the possible contribution to reaching the target, compatibility with limiting the amounts due in bills, improvement of environmental performance and concurrence with other targets. Alternatively, and provided that the exploitable potential is considerable, instruments will be assessed such as contribution to investment, including from specific European funds, including those for research and innovation.

In this context a provision to support these technologies (RES2) is being drafted. This will complete the work of the support measures already activated before the new Renewable Energy Directive was implemented, and will incentivise, by means of the usual auction (plants with power above 1 MW) and register mechanisms (plants with power below 1 MW), sources and technologies not covered by Ministerial Decree RES1. These include conventional geothermal energy with notably reduced emissions limits and zero-emissions using total reinjection pilot plants, biomass and biogas. The possibility of incentivising other sources and technologies is being considered.

In addition, in the context of the decommissioning of platforms and connected infrastructures already used for production from hydrocarbon reserves that are depleted, almost depleted or in any case unusable, innovative energy reconversion projects will be promoted. These include energy production plants fuelled by available marine resources (Ministerial Decree of 15 February 2019 – national guidelines on the decommissioning of platforms for producing hydrocarbons at sea and connected infrastructure). Marine energy resources also appear to be of potential interest for a number of companies, on account of

their potential synergies with core activities. They can therefore contribute to a gradual move by those companies towards activities that are compatible with energy transition targets.

- **Smaller islands as test projects for higher levels of penetration of renewables and for electrification of consumption**

Italy has already started a process for the gradual coverage of the requirements of smaller islands not interlinked with energy from renewable sources. In this context, the Ministerial Decree of 14 July 2017 sets out specific targets for covering consumption with renewable energy sources, available locally for each island. It establishes specific incentives, the scope of which is defined by ARERA Decision No 558 of 6 November 2018 and is proportionate to the avoided fuel cost. The aim is to promote, for each island:

- modernisation of electricity networks to allow in more renewables;
- implementation of pilot projects designed to increase the use of renewables by using storage systems, developing electric transport, integrating the electricity system with the island water systems and with the scalable demand on the island. The public call for projects is being finalised and will allow experimentation with innovative technological solutions that could potentially be used in the national energy system.

- **Strengthening Guarantee of Origin framework**

The aim is to strengthen the Guarantee of Origin framework by promoting its use for PPAs and evaluating the recognition of such guarantees for all energy produced.

Specific measures for safeguarding and improving existing plants

Achieving targets for renewables implies the construction of new plants but also the maintenance and, if possible, the increase of renewable production by existing plants. In this, the approach is to provide support primarily through measures to simplify and clarify the legislative framework, using support instruments only where such measures are not sufficient. In parallel, measures to safeguard the production of plants subject to bankruptcy or seizure by the judicial authorities will be introduced.

The following actions are planned.

- **Revamping, repowering and reconverting**

Notwithstanding the contents of the previous section in relation to hydroelectric concessions, the specific measures of a non-economic nature for revamping and repowering existing installations include the following.

- SAPs, setting criteria that enable actions to be taken to extend them and exclude or simplify EIA/environmental screening. In particular, for assessments of an environmental nature, an approach will be favoured which essentially evaluates the variations of the impact in relation to the situation prior to the revamping or repowering;
- The setting of basic limits and conditions, compliance with which will result in simpler interventions (for example, replacing plant components, which do not alter the layout or the land involved), subject merely to communication of same. Also, clearer definitions of substantial and non-substantial variations in projects for new plants or interventions on existing plants.
- More and better information on plant performance circulated by GSE, based on the

data acquired through the management of incentivisation mechanisms. This will help work towards:

- Promoting the dissemination of innovative technologies for smart performance monitoring;
 - identifying, within similar categories of plants, potential measures to improve performance and to extend the useful life of the plants;
 - promoting the development of an operational cycle associated with the recovery of production performance and the special maintenance of plants in demise;
 - raising awareness among plant operators about how plant performance can be optimised.
- Promoting the reconversion of some types of plant which, at the end of the incentives period, should in theory no longer be competitive on the market, into plants that better meet the needs of the system in its energy transition journey. This includes, for example, the reconversion of biogas plants to biomethane, already provided for in the existing legal framework. In this respect, diversification of the use of agri-industrial by-products with respect to the current regulatory framework, in line with the provisions of RED II, will be assessed.
- This option, feasible for large plants, appears to be more complex for smaller plants. For these, especially those in the agricultural sector, forms of support will be promoted that are efficient and compatible with EU rules on State aid, with a view to safeguarding production. The biogas plants in question must also be able to make efficient use of livestock manure, for the purposes of a well-functioning circular economy. To that end, the Budget Law for 2020 envisages the right to use an incentive on electricity produced. This applies to existing biogas-powered plants that started operating before 31 December 2017 and were built by agricultural entrepreneurs acting singly or in groups who do not benefit from other public incentives on electricity production. The incentive must comply with the sustainability criteria set out in Directive (EU) 2018/2001. To benefit from the incentive, the plants must use at least 40% in weight of manure and reconvert daily production in accordance with a programmable system in line with the conditions established each year by Terna SpA from 30 June 2020 onwards. The incentive will be established through the issuance of a decree by the Ministry of Economic Development in accordance with the rules on State aid.

- **Hydroelectric concessions**

Law No 12 of 11 February 2019 converting Decree-Law No 135 of 14 December 2018 gives the Regions authority in the area of existing large concessions. The Law provides, among other things, that where there is no overriding public interest in another use of the waters that is incompatible with their use for hydroelectric purposes, the Regions can grant concessions for large-scale diversions of water for such purposes to qualified operators on the basis of certain criteria. These include a) minimum improvements in terms of energy, production power and production potential to be achieved from the diversion, conveyance, regulation and supply of water and from the installations for generating, transforming and connecting electricity, with reference to the national strategic objectives on energy security and renewable energy sources. This includes the possibility of equipping the infrastructure with water storage facilities to promote the integration of renewables in the energy market. Also included are b) minimum thresholds in terms of environmental improvement and rehabilitation of catchment areas, in line with the catchment area planning instruments provided for in Directive 2000/60/EC on water policy. These determine a compulsory minimum share of any revenues deriving from the allocation to be channelled into financing

the measures contained in district management plans or plans for the environmental protection and rehabilitation of the bodies of water affected by the diversion.

Within the framework of agreeing on and sharing national objectives with the Regions, referred to above, an ongoing dialogue with the Regions will continue in order to promote an efficient and adequate application of these rules, to ensure that hydroelectric power can help meet the objectives.

At national level, support tools will be made available where necessary. This will also help promote the building of new plants on smaller water networks, for example harnessing the geodetic drop from aqueducts.

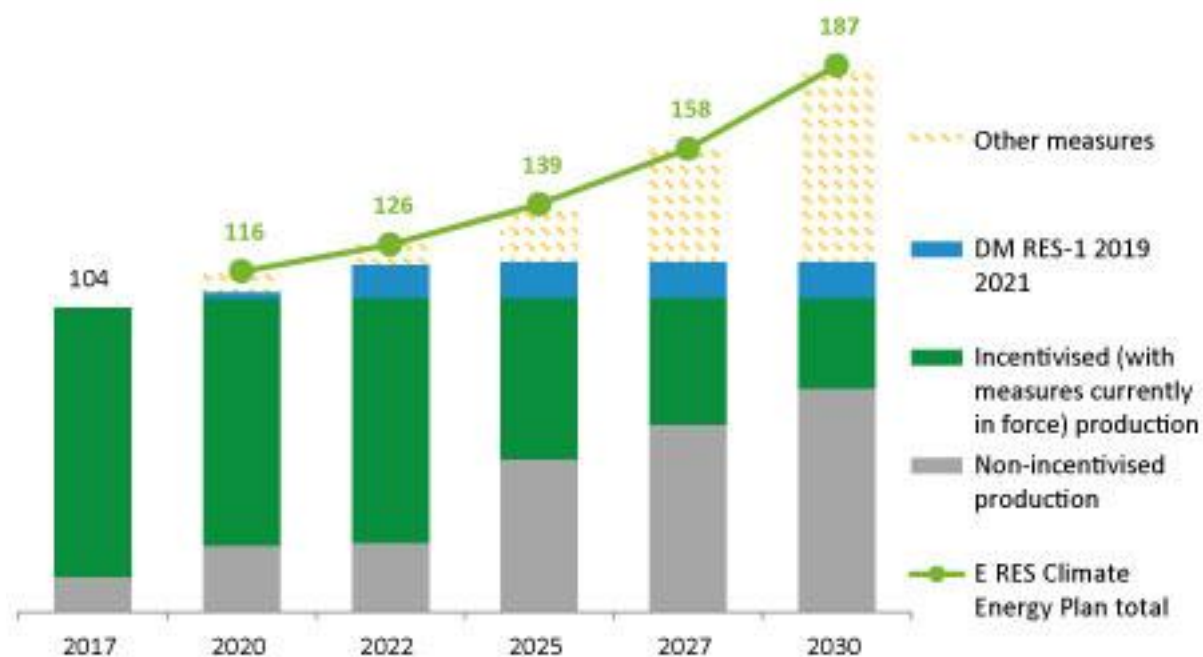
In addition, as regards the objective of simplifying authorisation procedures, the classification of 'substantial' and 'non-substantial' modifications to plants will be set out in national legislation (Article 5 of Legislative Decree 28/2011). With reference to substantial modifications to hydroelectric plants, plant modifications that necessitate a revision of concessions will be clearly identified. In that context, Law No 12 of 11 February 2019 provides for the regionalisation of the ownership of hydroelectric works, at the date on which the concession expires or in cases of revocation or relinquishment of the concession, with the subsequent concessions for large-scale diversions of water being allocated competitive tenders.

Italy continues, of course, to support the further harmonisation of the rules on hydropower concessions at European level.

Expected evolution of electricity generation

The expected evolution of electricity generation from renewable sources is shown below, highlighting different contributions: in the first place, non-incentivised production, which will increase in the coming years and which is to be maintained and optimised by some of the measures previously described, especially revamping/repowering; then production incentivised on the basis of mechanisms currently in force and production related to the measure most recently put in place; finally, the remaining share which will have to be implemented using the measures intended for new installations.

Figure 24 - Expected evolution of electricity from renewable sources and main contributions (TWh) [Source: GSE]



Transport sector

For the purposes of reaching the targets in relation to penetration of renewables in the transport sector, the following measures have been identified.

- **Mandatory biofuel mixing rate, up to 2022**

Mandatory release of biofuels for consumption, based on a share system in which, *inter alia*, a bonus is recognised for advanced biofuels and biofuels from waste oils and animal fats.

In this respect, it is important to adopt measures that are consistent Europe-wide, promoting the supply chain of energy based on biomethane, biofuels from waste oils and category 1 and 2 animal fats, safeguarding investments by biodiesel industries and further stimulating research and creation of innovative solutions. Lastly, support for the use of advanced biofuels is planned, by simplifying administrative procedures, transposing the end-of-waste provisions and promoting the advanced bioethanol segment.

- **Reduction of GHG emissions from fuels by 6% by 2020**

In 2020, fuel suppliers will have to meet a savings target, in terms of GHG emissions in the total fuels released for consumption in that year, in relation to a reference value.

- **Incentives to meet the biofuel emissions quota using biomethane and other advanced biofuels: 2018-2022**

Incentives to use biomethane and advanced biofuels for the purposes of meeting the existing obligation to mix fossil fuels with biofuels, through a system of collecting the biomethane produced, with issuing of certificates of release for consumption for a duration of ten years. The cost of the incentive is borne by the obligated parties (oil companies that release fossil fuels for consumption) and does not impact electricity and gas bills. It is envisaged that this incentivisation system will cover the predicted demand for methane in road transport with biomethane, corresponding to around 1.1 billion cubic metres a year.

- **Obligation to use biofuels and other renewables in transposing RED II: 2022-2030**

The drafting and issuing of an Italian Legislative Decree transposing RED II and subsequent interministerial decrees updating the decrees currently in force in the sector are planned. The main objectives are: updating the mandatory quotas for release for consumption of normal and advanced biofuels up to 2030; introducing differentiated targets for petrol, diesel and possibly methane; adding hydrogen from renewable sources and possibly fuels from recycled carbon to the list of biofuels and fuels that can be used for the purpose of meeting the quotas; establishing a link with the European database for monitoring sustainability; updating the multipliers to be used for the purposes of calculating the target; identifying the maximum percentages of use of first-generation biofuels; facilitating the use of pure advanced biofuels. The targets for different areas are as follows.

- First-generation biofuel: the contribution of this category of fuels is expected to decrease, ultimately to around 3%. The possibility of introducing lower limits for certain kinds of biofuels will be assessed, with particular reference to those which could generate an indirect land use change (ILUC). From 2023, this sub-target will have to be split between petrol and diesel or fuel oil, including with different contributions, and possibly methane.

- Advanced biofuels: the specific target provided for by the Directive, equivalent to 3.5% in 2030, is expected to be exceeded, so as to reach a sub-target of around 8%. These biofuels are produced from lignocellulosic materials, from non-food crops, residues and waste from agriculture and forestry, as well as industrial residues and waste. They represent a significant GHG saving of up to 100% and have almost zero ILUC impact. From 2023 this sub-target will have to be split between petrol and gasoline, including with different contributions, and possibly methane. To this end, the advanced biofuel sector will be promoted.

- As a preliminary estimate, 75% of the advanced biofuels target will be achieved by means of advanced biomethane (0.8 Mtoe) and 25% by means of other advanced biofuels (0.26 Mtoe). However, that breakdown could change owing to the actual availability and cost-effectiveness of different types of advanced biofuel. For advanced biomethane the target of at least 1.1 billion cubic metres by 2030 remains. According to various sources (IEA, IRENA, DENA, etc.), within the EU the availability of biofuels will rise from around 3 Mton at present to over 20 Mton in 2030. This will be made possible above all by the greater availability of raw materials, such as industrial and agricultural residues and waste, algae and other non-food crops. In particular, agricultural production efficiency will be improved, reducing costs along the whole chain and recovering and fertilising currently unfarmed areas: the reduction in costs in the sector is fundamental for making advanced biofuels more competitive. In addition, research and development in the algae sector and for all technologies for converting biomass into advanced biofuels will be stepped up. Lastly, the building and operation of biomethane production plants will be promoted, encouraging investment in this area.

- Annex IX part B fuels (used cooking oil and animal fats): the Directive imposes a ceiling of 1.7% (understood as a physical limit), giving Member States the possibility of increasing this value if amply justified. An increase up to 2.5% is proposed, with a final contribution equivalent to 5% at most (with double counting). This goal must be achieved solely with used cooking oil (UCO) and must give priority to UCO collected on national territory, respecting the principle of circular economy and in line with the new targets for the 'waste package'. UCOS have great potential for the production of biodiesel and hydrotreated

vegetable oil (HVO) for mixing with fossil diesel. On the other hand, the incorrect disposal of UCOs generates high risks of groundwater contamination and additional CO₂ emissions released as it breaks down. It is estimated that only 40% of used oils are properly recovered, that is, a total of approximately 2.5 Mton in Europe; the other 60% could potentially be a cause of pollution. Measures will therefore be adopted to facilitate the recovery of UCOs and their transformation into biofuels, employing the flexibility provided for in the RED II Directive. The possibility of increasing the maximum ceiling introduced by RED II of 1.7% for Annex IX part B biofuels will be considered, also potentially for animal fats classified as category 1 and 2 by Regulation (EC) 1069/2009 if the chain of production, collection and processing is entirely Italian;

- Electricity from RES in the road transport sector: a gradual increase is expected, from year to year, in new registrations of electric cars as well, in order to reach the cumulative target of around 4 million electric cars or electric vehicles by 2030, which, if added to plug-in hybrid cars, would reach a total of approximately 6 million electric cars 2030. Projections for the development of electric transport are linked to the expected technological improvements in batteries and will therefore be constantly monitored as part of periodic updates.

- Non-organic renewable fuels: the contribution of hydrogen in 2030 is realistically expected to be around 1% of the RES transport target, through direct use in hydrogen cars and buses as well as trains (for some non-electrified lines) or through the introduction of methane into the network, in that, within certain mixing thresholds (some studies indicate 5-15%) it is possible to exploit existing infrastructures without taking any special measures. An indication of differentiated use could be 0.8% of gas introduced into the network in its unaltered state or reprocessed into methane and 0.2% for direct use in cars, buses and trains. Through research, development and demonstration, the production and use of hydrogen produced from renewable electricity will be promoted, as it offers the dual advantage of reducing fuel emissions and emissions from other refining products. At the same time, it enables the storage of excess renewable electricity generated when supply exceeds demand. This technology also has the potential to strengthen the European refining industry's position as leader with future low-carbon solutions such as power-to-liquid, power-to-gas and H₂ for transport. In power-to-liquid, green hydrogen reacts with CO₂ (captured from the air or derived from waste) to produce a mix of hydrocarbon chains similar to those found in crude oil (and fuels).

- Recycled fossil fuels (for example: plastics collected separately or fuel obtained from recovery of CO₂ from steelworks): the contribution to the RES transport target will be established following the publication of the 'GHG saving' values by the European Commission (expected by 2021, according to the Directive), following the determining of minimum sustainability requirements for these fuels. The management and treatment of waste is a big issue for developed countries and, increasingly, in developing ones. The refining industry is developing alternative solutions to dumping and incinerating waste and plastic residues. One of the technologies being developed is anaerobic thermal pyrolysis to produce oil from thermal cracking, which can be used in refineries in partial place of crude oil. Legislative instruments to promote synergies between the refinery industry and waste treatment will be explored from a circular economy perspective.

- advanced biomethane from the organic fraction of municipal solid waste and agricultural waste: the target of 1.1 billion cubic metres by 2030 for the road transport sector is confirmed.

There are also plans to introduce measures to promote the use of biofuels in the railway, aviation and maritime sectors. These include use of renewable gases (mainly hydrogen).

The aviation sector's contribution to decarbonisation is expected to be realised through the use of low-carbon renewable liquid fuel, which can be blended with traditional aviation fuel (under the ASTM D 7566 standard). The IEA predicts that by 2050 around 60% of aviation fuel consumed globally will be biokerosene. This new type of fuel, which meets the sustainability criteria set out in EU directives, enables CO₂ emissions to be reduced, depending on the raw material used, by as much as 80% over the entire life cycle compared with traditional aviation fuel.

The International Civil Aviation Organisation (ICAO) has involved operators in the sector (aircraft producers, airports and fuel users) in the Carbon Offsetting Reduction Scheme for International Aviation (CORSIA), which aims to pursue emission reduction in the sector from 2020 onwards. Joining CORSIA is voluntary, but membership will become mandatory in 2027.

RED II, published in December 2018, also incentivises the supply of non-food and feedstock biofuels to the aviation sector. The contribution of such fuels can be counted as 1-2 times with respect to the energy content of a conventional biofuel; they are thus recognised as one way of meeting the obligation to produce renewable energy.

Europe's climate ambitions have been reflected in recent discussions on taxing flights and aviation fuel within the EU, in order to ensure a level playing field for all types of transport. In fact, fossil fuels for aviation are not currently subject to taxation either for domestic flights or international flights, even though some Member States apply passenger taxes.

Among the technologies available, existing plants use 'hydrogenation of esters and fatty acids' derived from biomass. Current capacity is already being used to produce renewable transport fuels (HVO), and when properly integrated can produce biomass-derived 'renewable aviation fuels'.

Production development means bearing extra costs that are holding back investment decisions, given the uncertainty of the end market. At the same time, the lack of product availability has not helped demand to grow. To stop this vicious circle, it will probably be necessary to create incentives for use that take the global nature of this market into account.

The measures listed above will naturally go hand in hand with measures to promote electric mobility, described below, in terms of creating energy efficiency by using hydrogen as an energy carrier.

Heating sector

In order to meet the mandatory national target in relation to renewable energy, the contribution of the heating sector is fundamental. The final gross consumption on a national level intended for heating and cooling is in fact around 56 Mtoe, equivalent to slightly less than 50% of final overall energy consumption.

The principal instruments that are expected to be used to promote the use of thermal renewable energy sources are often integrated with those for energy efficiency and are already operational. These are:

- tax deductions for energy efficiency measures and restoration of existing buildings, both also intended for thermal renewables;
- 'Conto Termico' (Thermal energy account);

- White Certificates system, including promotion of high efficiency cogeneration;
- mandatory integration of energy from renewable sources in buildings;
- contributions to municipalities towards investment in the field of energy efficiency and sustainable local development.

All of the above measures, already operational at a national level, are better described in section 3.2.1.2. They are briefly detailed below, with reference to the parts relevant to thermal renewables, including the corresponding areas of development planned in pursuit of the 2030 targets for these thermal renewables.

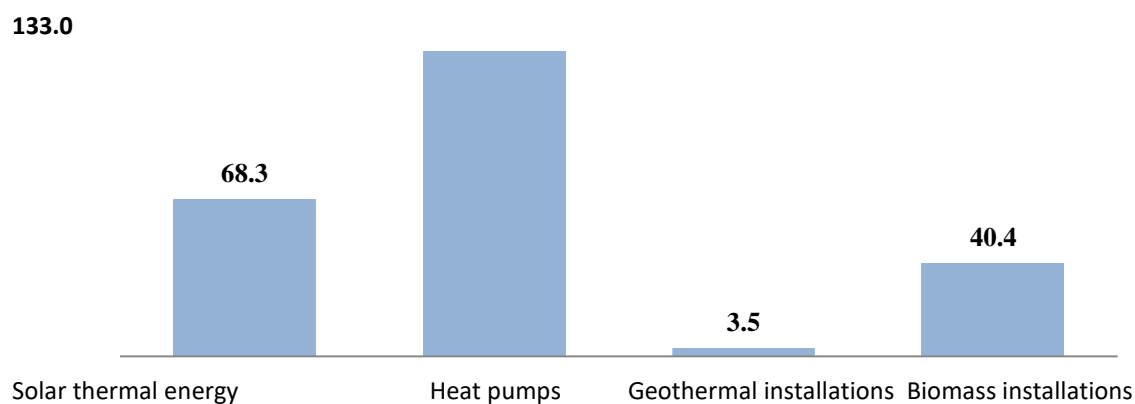
- **Tax deductions for energy-efficient retrofitting and restoration of existing buildings**

Tax deductions for energy-efficient retrofitting of buildings are currently in place and have played a vital role in the development of energy efficiency and of thermal renewable energy sources in the housing sector.

For thermal renewables, the fitting of solar thermal installations, heat pumps, geothermal installations in buildings, replacing existing winter heating systems, and biomass installations is made easier.

As regards the fitting of installations using thermal renewable energy sources, the period 2014-2017 saw around €980 million of investments stimulated by this measure.

Figure 25 - Average annual investment in installations using thermal renewable energy sources in tax deductions for energy-efficient retrofitting of buildings (millions of €)



Tax deduction for restoration of buildings, introduced in 1997 and still in place, facilitates installation of solar thermal installations, heat pumps, geothermal installations and biomass installations in buildings.

- **'Conto Termico' (Thermal energy account)**

With Italian Ministerial Decree of 28 December 2012, the Conto Termico was introduced, an incentive for promoting the production of renewable thermal energy and, at the same time, to permit access by public sector bodies to energy-efficient building works and installations. The Thermal Account became operational in July 2013.

In relation to production of heat from renewable sources, one or more interventions, listed below, carried out by public authorities and by private individuals, are incentivised:

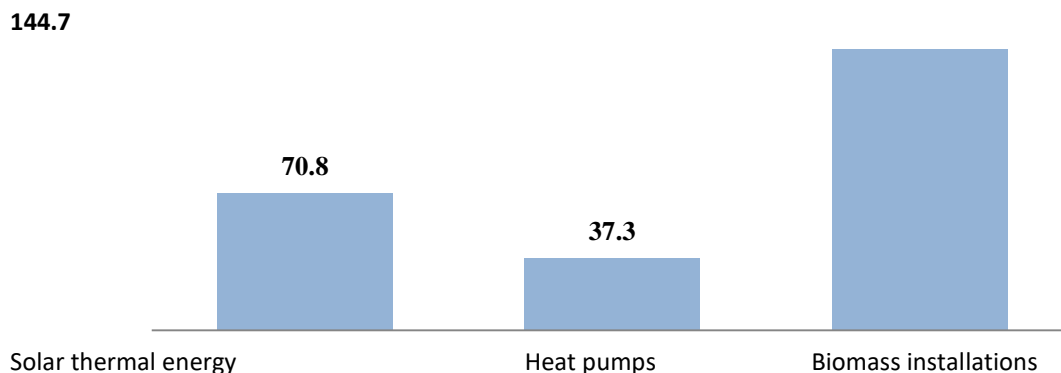
- replacement of existing winter heating systems with winter heating systems, including combined systems for producing domestic hot water, equipped with electric or gas

heat pumps, using aerothermal, geothermal or hydrothermal energy, along with the installation of heat metering systems in the case of installations with useful thermal output greater than 200kW; the maximum limit for applying for the incentive is nominal total power (post operam) of 2,000 kW;

- replacement of existing winter heating systems or existing systems for heating greenhouses and rural buildings with winter heating systems equipped with a biomass-powered heat generator, along with the installation of heat metering systems in the case of installations with useful thermal output greater than 200kW; the maximum limit for applying for the incentive is nominal total power (post operam) of 2,000 kW;
- fitting of solar thermal installations for production of domestic hot water and/or for the integration of the winter heating system, including linked to solar cooling systems, for production of thermal energy for production processes or for networking of district heating and district cooling systems. In the case of solar field areas greater than 100 m², the installation of a heat metering system is required; the maximum limit for applying for the incentive is a total installed floor area of 2,500 m²;
- replacement of electric water heaters with water heaters with a heat pump;
- replacement of existing winter heating systems with hybrid heat pump systems.

In 2017, requests were present for around 40 000 fittings of installations using renewable energy sources, equal to around €250 million invested.

Figure 26 - Estimate of average annual investment in installations using thermal renewable energy sources in the Conto Termico (millions of €)



• White certificates

White certificates are tradeable assets which certify that a reduction of end -use energy consumption has been attained as a result of interventions and projects to increase energy efficiency.

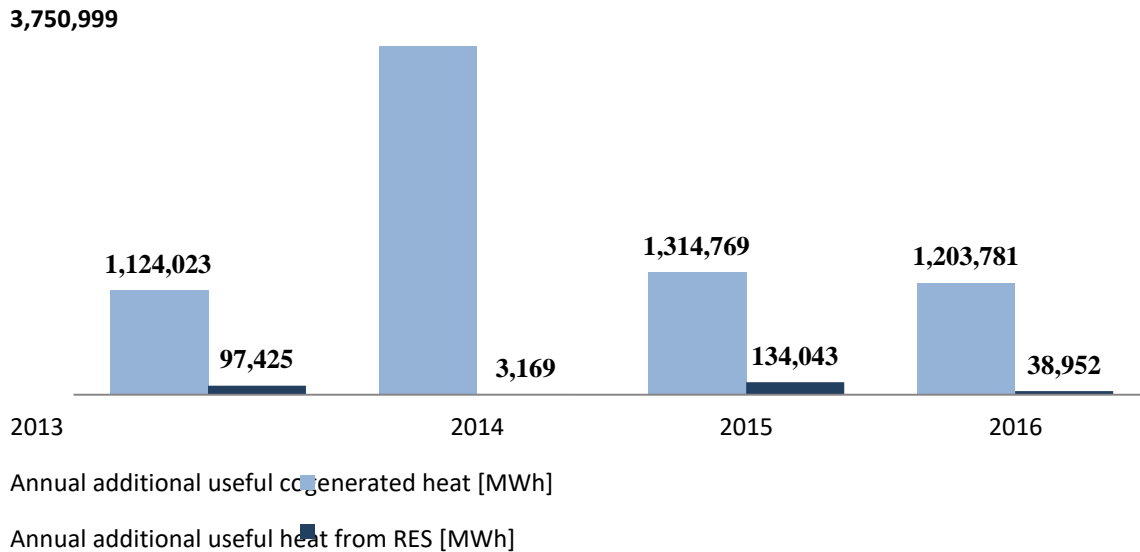
As part of this scheme, the development of projects that provide for use of renewable sources for non-electric uses is also encouraged, in relation to their capacity to increase energy efficiency and to permit savings of non-renewable energy.

White certificates are issued for energy savings as a result of high-efficiency cogeneration installations, including installations using renewable energy sources and installations linked to district heating networks.

As regards high-efficiency cogeneration installations, they record on average a volume of useful recovered heat that varies between 31 and 38 TWh annually, of which around 1.2 TWh

annually are on average an increase on the previous year. Of this annual increase, renewable energy constitutes a proportion varying from 40 to 140 GWh.

Figure 27 - Useful recovered heat from high-efficiency cogeneration installations (MWh)



- Mandatory integration of energy from renewable sources in buildings**

Annex 3 of Legislative Decree No 28 of 2011, transposing the RED Directive, identifies obligations to integrate energy from renewable sources in new buildings or in buildings subject to major renovation, in force from 31 May 2012.

The requirements are currently fixed in terms of percentages (increasing per year) of coverage with renewable energy sources of the building's energy requirement for providing heating, cooling and domestic hot water services.

In particular, it is envisaged that in the case of new buildings or buildings subject to major renovation, installations for the production of thermal energy have to be designed and created so as to guarantee compliance with coverage, with energy produced from installations powered by renewable sources, of 50% of expected consumers of domestic hot water and of the following percentages of expected consumers of domestic hot water, heating and cooling:

- 20% when the application for the relevant building licence was submitted between 31 May 2012 and 31 December 2013;
- 35% when the application for the relevant building licence was submitted between 1° January 2014 and 31 December 2016;
- 50% when the application for the relevant building licence was submitted from 1° January 2017 (then extended to 2018).

Where it is technically impossible to meet the obligation to cover the energy requirements of buildings undergoing first-level restructuring, the possibility for the owner to install the mandatory percentage in another building, including a building owned by others, or transfer it to the local authority will be assessed. In such cases, the local authority could then build up sufficient quotas suitable for interventions on public buildings will be assessed, as long as this

is compatible with the obligations deriving from the Directive on the energy efficiency of buildings.

Development trends for mechanisms to promote thermal renewable energy sources

In order to track the development trends for measures to promote installations for the production of renewable thermal energy, it is necessary to consider emissions from solid biomass installations. Therefore, promotion measures will favour installations with high quality environmental standards that are highly efficient. In order to encourage revamp of old installations with efficient technologies and reduced emissions, the measures described will be updated, introducing more stringent performance and environmental requirements for biomass heat generators. The introduction of requirements regarding the substitution of obsolete heating equipment and periodic monitoring and maintenance obligations for biomass plants (telematic real estate register) will be assessed, as also emerged from the public consultation.

For electric and gas heat pumps, a technologically neutral approach will be maintained, leaving the selection of the most efficient option for each application to the market, and also valuing their contribution in cooling mode, taking into account that in some regions of Mediterranean countries, cooling requirements predominate. As emerged from the public consultation, promotion mechanisms will be geared towards encouraging the widespread use of geothermal heat pumps.

To promote the widespread use of solar thermal energy, the technology for which has not to date seen any significant growth, regulations will be updated regarding mandatory integration of a minimum renewable energy quota in new buildings or buildings subject to major renovation. In addition, in order to promote fitting of solar thermal installations that can handle the heat demand in a more flexible and effective way (for example by covering the need for the buildings' heating services), it will be important to demonstrate promotion of hybrid systems as a part of the incentives.

The obligation to integrate energy from renewable sources in buildings, which has had many advantages in terms of improvement of energy performance in buildings and increasing use of thermal renewable energy sources, as the results of the public consultation also showed, must now be made more effective in order to widen its scope and ensure its application in all of the cases provided for. In particular, there are plans to update the obligations system, making it simpler and immediately applicable, introducing for example a list of renewable technologies from among which the designer can choose, on a case-by-case basis and based on the characteristics of the building, promoting, as stated above, the integration of traditional technologies with renewable ones, including through the use of hybrid installations. When extending the scope of the obligation, links can be made with the existing promotion instruments, for the purposes of optimising the ratio between costs and benefits of the investments for fitting installations for the production of renewable thermal energy.

On the basis of the results of the measures described above, and consistent with the measures for electric renewables, the step will be considered of introducing a mandatory minimum quota also for several categories of existing buildings, including tertiary buildings.

- **Contributions to the municipalities for investment in the field of energy efficiency and sustainable local development**

Decree-Law No 34 of 30 April 2019 (the Growth Decree-Law) established a contribution for municipalities, up to a maximum of €500 million for 2019, drawn from the Development and Cohesion Fund (FSC), to be channelled into investment in energy efficiency and sustainable local development. The contribution is allocated to each municipality on the basis of the resident population as at 1 January 2018, as follows:

- a) €50,000 to municipalities with a population of below or equal to 5,000;
- b) €70,000 to municipalities with a population of between 5,001 and 10,000;
- c) €90,000 to municipalities with a population of between 10,001 and 20,000;
- d) €130,000 to municipalities with a population of between 20,001 and 50,000;
- e) €170,000 to municipalities with a population of between 50,001 and 100,000;
- f) €210,000 to municipalities with a population of between 100,001 and 250,000;
- g) €250,000 to municipalities with a population of over 250,000.

The contributions are to be used for public works in the areas of:

- a) increasing energy efficiency, including public lighting, energy saving in publicly owned buildings and public housing, and the installation of energy production plants fuelled by renewable sources;
- b) sustainable local development, including measures for sustainable mobility, upgrading and safety assurance in schools, public buildings and municipal property, and removing architectural barriers;

From 2020, for the above-mentioned projects, the Growth Decree-Law has authorised the implementation of a multi-year funding programme, with resources to be shared equally among municipalities with populations of below 1,000.

In the Director's Decrees of 14 May and 10 July 2019, the Ministry of Economic Development set out the size of contribution for each Italian municipality and the methods for implementing the measure (eligible interventions, the contribution that can be granted and the methods of delivery, monitoring of the measure).

The Budget Law for 2020 assigns contributions of up to €500 million per year in total to the municipalities for investment in public works for increasing energy efficiency. Areas for investment include public lighting, energy saving in publicly owned buildings and public housing, and the installation of energy production plants using renewables. The subsidies can also be used by the municipalities for projects in the areas of sustainable local development, sustainable mobility, upgrading and safety assurance in schools, public buildings and municipal property, and removing architectural barriers.

In order to exploit the potential of district heating described in chapter 2, the instruments currently available will be upgraded to promote new construction and expansion of infrastructure for distribution of heat in urban areas, in particular in such a way that the heat generation hubs are close to the consumption sites. In this regard, priority will be given to developing efficient district heating, namely that based on distribution of heat generated largely from renewable sources, from waste heat or cogenerated heat (prospectively also biomethane-generated heat). To this end, there will be confirmation of the economic reserve to provide guarantees in favour of measures to create district heating and district cooling networks, included in the National Fund for Energy Efficiency, and the implementing decree,

already approved by Law No 172/2017, will be issued. This provides measures to facilitate work on installations which brings about an increase in the thermal production capacity for the purpose of maintaining or achieving the set-up of an efficient district heating system, and which is accompanied by an extension of the network in terms of an increase in transport capacity.

ii. Where relevant, specific measures for regional cooperation, as well as, as an option, the estimated excess production of energy from renewable sources which could be transferred to other Member States in order to achieve the national contribution and trajectories referred to in point 2.1.2

Regional cooperation on RES between neighbouring countries (Malta, Croatia, Austria, Greece and France) could be based on sharing projects for the development of plants at sea (off-shore wind, marine and wave energy plants) and on the broadening of support mechanisms. Regarding the statistical transfer that has been the subject of discussions, all the countries are open to this where feasible, in that it is a need that can only be assessed along the way. Some experiments to that end are undergoing preliminary analysis, in the framework of reaching the 2020 objectives. In this context, some countries have sounded out Italy's willingness to carry out a statistical transfer, that is, to give up the surplus it will probably have with respect to reaching its own target for the share of energy met from renewable sources in 2020.

iii. Specific measures on financial support, where applicable, including Union support and the use of Union funds, for the promotion of the production and use of energy from renewable sources in electricity, heating and cooling, and transport

See point i.

iv. Where applicable, the assessment of the support for electricity from renewable sources that Member States are to carry out pursuant to Article 6(4) of Directive (EU) 2018/2001

Evaluation of the effectiveness of support for electricity from renewable sources and its principal distributive effects on the different categories of consumers and on investments will be carried out during the monitoring of the Plan.

v. Specific measures to introduce one or more contact points, streamline administrative procedures, provide information and training, and facilitate the uptake of long-term power purchase agreements. Summary of the policies and measures under the enabling framework Member States have to put in place pursuant to Article 21(6) and Article 22(5) of Directive (EU) 2018/2001 to promote and facilitate the development of self-consumption and renewable energy communities

Several elements are provided in section 3.1.2, point i. In terms of administrative procedures and points of contact, the following is specified.

In Italy, from the early 2000s to the present day, there has been a progressive simplification and streamlining of the authorisation procedures aimed at permitting the fitting of installations for producing energy from renewable sources. In this time period, there has also been a significant change in the division of responsibilities between the bodies involved, with a greater decision-making role for the Regions, including in relation to principles established

by the State, in energy-related matters and, as regards renewables, in environmental assessments. The principal procedural paths provided in the existing legislation for construction of installations, differentiated according to their size and characteristics, are the Single Authorisation, the Simplified Authorisation Procedure and Communication to the Municipality. For some electrical production installations, a harmonised model is also envisaged, which allows a uniform and simple procedure to be used for everything required to create and operate the installation. These measures allow the interested party to always have a single point of contact in order to obtain the licence. In relation to training, Italy has already adopted a training standard for extraordinary installation and maintenance operations for electric installations powered by renewable energy sources, to give effect to Directive 2009/28/EC, and in cooperation with the Regions. Equally, as regards information, an information portal has already been introduced with information about national renewable energy incentives, about the costs and benefits of the system. As indicated in section 3.1.2, these activities will be reinforced by exploiting the wealth of data and knowledge available from GSE, which is responsible for management of the support measures, and from the ENEA, which fulfils the role of national agency for energy efficiency in Italy, starting dialogue with local bodies, consumer associations and SMEs, to make these groups more aware of opportunities and conditions for evaluating the convenience and the conditions for taking steps to improve energy efficiency and for self-consumption.

Italy has also established a monitoring body with the Regions which has, inter alia, the objective of spreading good practice in terms of authorisations. In that respect, it is important to step up the involvement of the Regions and local bodies in the production and sharing of statistics, which also help interventions to be planned more efficiently. This requires the resources of the participants in the statistical system, including Terna, GSE and ENEA, to be strengthened. At the same time, this increased synergy must be reflected in the work of the Regions and local bodies, both in terms of statistics and of the exchange of administrative data (authorisations, proceedings under way, measures with an impact in terms of energy efficiency, etc.) for which data provision obligations already exist.

In addition, a preliminary exchange of information on regional policies on environmental and energy-related planning would be desirable, as happens with measures taken at national level, subject to the opinion or agreement of the Conference of the Regions and Autonomous Provinces. In essence, it is necessary, under a framework of national rules and regulations which are clear and as stable as possible over time, to establish more systematic and coordinated regulation, with harmonisation of the regional legal framework. This would reduce the risk of guidelines being adopted which depart from the national framework and differ fundamentally from one another. A useful tool to this end would be the adoption of a standardised format for issuing authorisations at national level which would harmonise time frames, methods and procedures. A process for benchmarking national authorisation procedures against European ones could also be useful in order to assess process performance, including by means of specific performance indicators.

The public consultation also showed that the associations recognise the important role the Regions play in sharing the complete and updated mapping of constraints and requirements.

vi. Assessment of the necessity to build new infrastructure for district heating and cooling produced from renewable sources

As came out of the assessment report on the national potential for the application of high-efficiency cogeneration and efficient district heating, in accordance with Article 14 of the EED

and drawn up by GSE, the economic potential for expanding district heating and cooling networks on a national level is currently estimated at around 900 km, in addition to the existing around 4 100 km.

The economic potential relating to DH powered by biomass is equal to an increase of 0.7 TWh of thermal energy per year supplied to users, for an expansion of the networks by 253 km and 14 million m² of heated space.

Table 27 - Economic potential for expanding efficient biomass district heating networks (based on 2013 consumption) [Source: GSE - Assessment report on the national potential for the application of high-efficiency cogeneration and efficient district heating]

	Climate condition area D	Climate condition area E	Climate condition area F	Overall Total
Incremental economic potential [GWh]	78	307	310	696
Incremental length of networks [km]	29	101	123	253
Incremental heated space [million m ³]	2	6	6	14
Incremental thermal capacity CHP [MWt]	20	62	48	131
Incremental supplemental thermal capacity [MWt]	59	181	138	378
Incremental heat output CHP supplied [GWh]	35	136	137	308
Incremental supplemental heat output [MWt]	44	171	173	388
Incremental electricity capacity CHP [MWel]	4	13	10	28
Incremental electricity produced CHP produced [GWh]	9	35	35	78
Incremental non-HE CHP electricity produced [GWh]	-	-	-	-
LCOH [€/MWh]	120	102	103	108
Saved emissions [ton CO ₂ eq]	4,481	17,577	17,741	39,799
Primary energy savings [toe]	8,970	35,182	35,511	79,663

For other considerations and further developments, see under point 2.1.2.ii

vii. Where applicable, specific measures on the promotion of the use of energy from biomass, especially for new biomass mobilisation taking into account:

- the availability of biomass, including sustainable biomass: national potential and imports from third countries

- other uses of biomass in other sectors (agriculture and forestry sectors); and measures for sustainability of biomass production and use

3.1.3 Other elements of the dimension

i. National policies and measures affecting the ETS sector and assessment of the complementarity and impacts on the EU ETS, if applicable

As detailed in section 2.1.1, by 2030, the production sectors that are part of the ETS scheme should record, in the scenario with targets, a reduction of emissions of around 56 % in relation to 2005, a level clearly higher than the aggregated European target (-43 %).

This differential is partly explained by the economic and energy trends, partly by the measures to be implemented.

In fact, in the 'base scenario' (that envisaged by the existing policies), by 2030 the ETS sectors should in any event record a drop of emissions of around 45 %, as a result of, besides the quantitative constraints and increasing prices of CO₂, the long recovery time after the economic crisis (in some sectors, the level of industrial production is still below that of 2005) and of the concurrent increasing production capacity of renewables (production between 2016 and 2030 should in any case increase by around 20%).

The effect of the measures to be implemented will add to this trend. The emission differential between 'base scenario' and 'scenario with policies', also considering the interaction between individual decarbonisation measures, is around 27 MtCO₂eq. In particular, the process for the phase-out of carbon by 2025 is combined with the further significant acceleration of renewables, led by photovoltaics and wind power (by 2030 the increase in electricity production in relation to 2016 will have risen to 75%) and an increase in efficiency with limitation of industrial energy consumption.

ii. Policies and measures to achieve other national targets, where applicable

iii. Policies and measures to achieve low emission mobility (including electrification of transport)

For an extensive description of measures to achieve low emission mobility please refer to sections: 3.1.1. for measures relating to reducing emissions, 3.1.2 as regards the promotion of renewable energy in transport, and section 3.2 for measures for reduction of sectoral energy consumption. Below is a list of the principal measures which contribute to the promotion of low-emission mobility.

- *Measures referred to in section 3.1.1.*

• **Progressive ban on use of cars that produce most pollution**

Italian Law 190/2014 progressive ban on use of category M2 and M3 motor vehicles powered by petrol and diesel (EURO 0) from 1 January 2019, and planned ban of use of category M2 and M3 motor vehicles powered by petrol and diesel (EURO 0 e EURO 1) in services contracts from 1 January 2018.

- *Measures referred to in section 3.1.*

• **Incentives to meet the biofuel emissions quota using biomethane and other advanced biofuels: 2018-2022**

Incentives to use biomethane and advanced biofuels for the purposes of meeting the existing obligation to mix fossil fuels with biofuels, through a system of collecting the biomethane produced, with issuing of certificates of release for consumption for a duration of ten years. The cost of the incentive is borne by the obligated parties (oil companies that release fossil fuels for consumption) and does not impact electricity and gas bills. It is envisaged that this incentivisation system will cover the predicted demand for methane in road transport with biomethane, corresponding to around 1.1 billion m³ a year.

• **Obligation to use biofuels in transposition of RED II: 2022-2030**

The drafting and issuing of an Italian Legislative Decree transposing RED II and subsequent interministerial decrees updating the decrees currently in force in the sector are planned. The main objectives are: updating the mandatory quotas for release for consumption of normal and advanced biofuels up to 2030; introducing differentiated targets for petrol, diesel and possibly methane; adding hydrogen from renewable sources and possibly fuels from recycled carbon to the list of biofuels and fuels that can be used for the purpose of meeting the quotas; establishing a link with the European database for monitoring sustainability; updating the multipliers to be used for the purposes of calculating the target; identifying the maximum percentages of use of first-generation biofuels, in accordance with Article 27 of Directive 2018/2001/EC and with the related Delegated Regulation on Governance of the Energy Union and Climate Action (Regulation (EU) 2018/1999). In particular, paragraph 1(b) of Article 27 of Directive (EU) 2018/2001 imposes a maximum ceiling of 1.7% for the raw materials referred to in Annex IX, part B, that is, UCOs and animal fats, leaving to Member States the possibility to increase that value where properly justified. The ceiling is expected to be increased (from 1.7% to a maximum of 2.5%) for waste vegetable oils, with priority given to UCOs collected in Italy, in line with the principle of the circular economy and the new targets set by the waste package. The contribution is expected to be 0.6 Mtoe in 2030. The real 2%, in terms of the contribution to the RES-Transport target, will be equal to 4%, owing to double counting. This expectation is justified by the large-scale production and use of vegetable oil in Italy (mostly olive oil but also oil from oil seeds) compared with the other EU countries, which means there is a wide availability and potential for collection and use of those oils for producing advanced and sustainable biofuels. When they are not properly collected and reused, these oils cause serious damage to the environment. Special measures will be taken to increase the quota of UCOs collected and used to produce biofuels.

Italy uses over a third of all olive oil consumed in the EU and around a sixth of olive oil consumed worldwide. This justifies a higher quota for biofuels produced using UCOs in Italy, which needs to manage such waste intelligently, gaining economic benefit from it and protecting the environment.

Figure 28 - Olive oil consumption in EU: 2010-2018 (in thousands of tons) [Source: International Olive Council]

EU consumption broadly stable in 2018/19

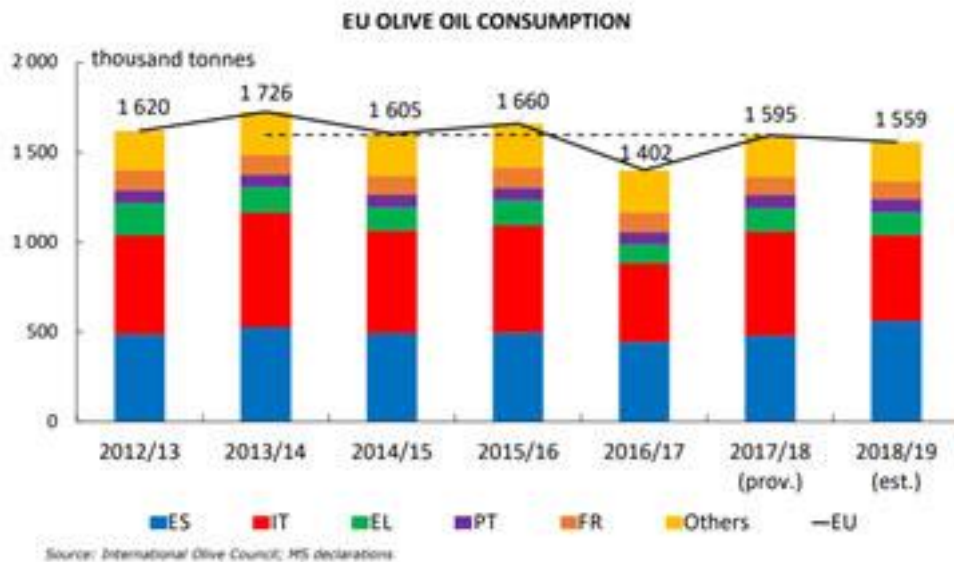
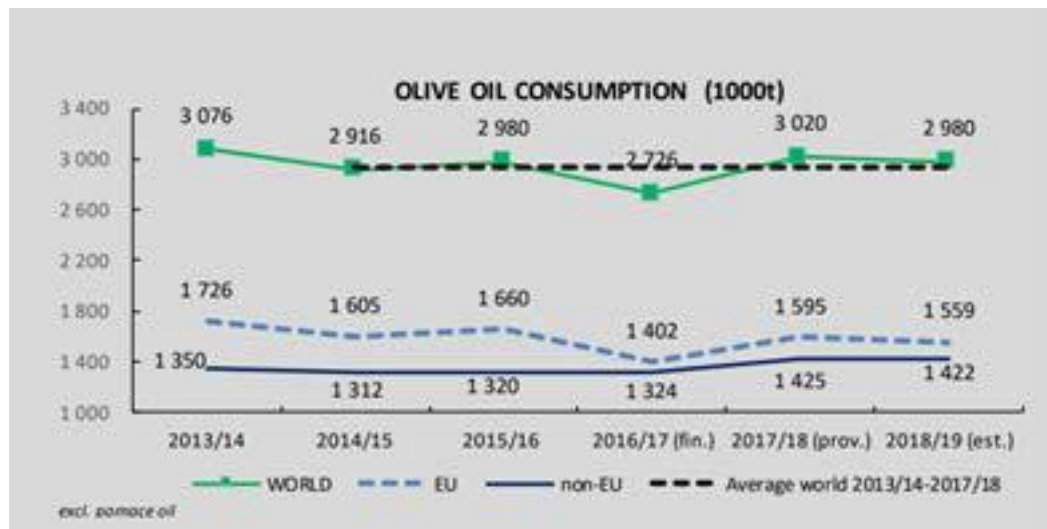


Figure 29 – Global consumption of olive oil: 2013-2018 (thousands of tons) [Source: International Olive Council]



The possibility of increasing the ceiling of 1.7% imposed under RED II for the biofuels listed in Annex IX, part B will be assessed, also taking into consideration animal fats classified as category 1 or 2 by Regulation (EC) 1069/2009, if the production, collection and processing chain is entirely based in Italy.

- Measures referred to in section 3.2

Replacement of public vehicles used for the transport of persons

- Funding for replacement of the road transport fleet used for the transport of persons

In the Stability Law 2017, the Italian government launched a significant funding plan for replacement of the road transport fleet used for local public transport for the period 2019-2033. It involves in particular electric and methane buses to supplement and replace the existing bus fleet. In discussion with the Regions and local authorities, it has also been decided to establish an inter-institutional political group for debate and consultation in relation to transport, composed of the Ministries for Infrastructure, Economic Development and the Environment, as well as the Regions and local authorities.

- **Mandatory purchase of alternative fuel vehicles by public bodies (beyond the first transposition of the DAFI directive)**

This proposes to accelerate the provisions set out in paragraph 10 of Article 18 of Italian Legislative Decree 257/2016 (transposition of the DAFI directive) stipulating that public bodies, organisations and institutions dependent thereon or controlled thereby, the Regions, local authorities and providers of public utilities for activities carried out in the provinces with high levels of PM10 particle pollution, when replacing their respective fleets of cars, buses and public utility vehicles, including urban waste collection vehicles, must ensure that at least 30% (by 2022), 50% (by 2025) and 85% (by 2030) of the vehicles purchased must be electric and hybrid with off-vehicle charging, powered by methane and hydrogen, and electricity and methane in the case of buses.

Replacement of private vehicles used for the transport of persons

- **Incentives to purchase more efficient vehicles with lower climate-changing gas emissions**

The plan is to gradually review the tax system on transport (registration tax, ownership tax, taxes on fuel etc.) and study further methods of financing for promoting vehicles that run on alternative fuels, in particular electricity. The possibility will be assessed of public contributions to the purchase of hybrid and electric vehicles, other than for retrofitting obsolete internal combustion vehicles. The first measures in this regard have already been introduced, having effect from March 2019 to December 2021, and consist of the granting of subsidy to those who purchase a vehicle with CO₂ emissions lower than 70 g/km and an official price lower than €50,000. The subsidy is differentiated depending upon emission class (0-20 g/km and 21-70 g/km) and depending on whether the purchaser is at the same time scrapping a vehicle type approved in the Euro 1 to Euro 4 classes or not, and is between €1,500 and €6,000. The same law provides for the trial of innovative means of transport for personal mobility with primarily electric propulsion, including Segways, hoverboards and scooters. In contrast, the law provides, for the same period, for the payment of a tax for purchase of category M1, if the CO₂ emissions are greater than 160 g/km. The tax varies €1,100 to €2,500 based on emissions.

In addition, Decree-Law No 34 of 30 April 2019 (the Growth Decree-Law) established that anyone who, in 2019, bought, including via leasing, and registered in Italy a new electric or hybrid vehicle in category L1e, L2e, L3e, L4e, L5e, L6e or L7e and who took for scrapping a vehicle in one of those categories that they had owned or held for at least 12 months was entitled to a subsidy of 30% of the purchase price, up to a maximum of €3,000 in the event that the vehicle taken for scrapping belonged to EURO category 0, 1, 2 or 3. This also applies if the vehicle had been owned or held for at least 12 months by a cohabiting family member.

- **National Plan for Electric Vehicle Charging Infrastructure (PNIRE)**

The PNIRE, provided for by Law No 134 of 7 August 2012, aims to create infrastructure networks for charging electric vehicles and activities for the restoration of buildings aimed at the development of these networks. The Budget Law for 2019 also introduced tax deductions for the purchase and fitting of infrastructure for charging electric vehicles, valid from March 2019 to December 2021. The deduction was equal to 50% of expenses sustained, to be split into ten annual instalments.

The PNIRE is currently being updated using an integrated approach, which also considers other measures to sustain demand for electric vehicles and to strengthen and increase the usability of the related infrastructure. In addition, the possibility of coordinating the development of recharging infrastructure with the plans to rationalise the fuel network is being assessed.

Regulatory measures

Limits and rules will be introduced in relation to stopping, to access in certain areas and to parking. Local regulatory initiatives will also be evaluated and reinforced, including for example, limits on use of polluting vehicles in urban areas, with free access for alternative fuel vehicles and in particular electric vehicles in limited traffic zones, speed limits, priority lanes and car parks exclusively for zero-emissions vehicles. In addition, to disincentivise the use of private vehicles, it is proposed that local rules on access to urban areas be harmonised throughout the country. A first measure, introduced in the Budget Law 2019, provides that the municipalities, in imposing limits on access to several urban areas, permit free access to electric and hybrid vehicles.

All the national and regional initiatives for developing the electrical recharging infrastructure should be placed on a system footing within the PNIRE framework, while at the same time:

- making more recharging infrastructure available at service stations, on the motorway network and in existing buildings, by extending electrical fittings (in hotels, shopping centres, service stations, car parks etc.) and avoiding, where possible, the opening of a new POD;
- simplifying the administrative procedure for authorising the installation of recharging infrastructure accessible to the public;
- supporting electric public transport via a tariff regime.

- **Refuelling points for alternative fuels (DAFI)**

Italian Legislative Decree No 257 of 16 December 2016, transposing the Directive on the deployment of alternative fuels infrastructure (DAFI Directive), provides for an increase of:

- charging points (public and private) for electric vehicles from the current 2 900, approximately, up to at least 6 500 in 2020;
- sales points supplying CNG from the current number of around 1 100 to around 2 400 in 2030;
- sales points supplying LNG from the current number of a few dozen to around 800 in 2030

- **Replacement of vehicles used for the transport of goods**

Italian Ministerial Decree from the Ministry of Infrastructure and Transport 122/2018 provides incentives for purchasing commercial vehicles with alternative motorisation for transport of goods.

Reinforcement of the infrastructure

- **Regional rail transport**

For regional railways, following an efficiency assessment the electrification of even small parts of the regional rail network and the doubling of the tracks of the major one-track routes will be promoted with a view to increasing safety and speed, thus making rail travel more attractive. The Government will seek close collaboration with the Regions in monitoring the network and, subject to consultation with them, will envisage entrusting to the Italian railway infrastructure operator (Rete Ferroviaria Italiana (RFI)) some of the routes they currently manage.

- **Rapid mass transport systems**

The Budget Law for 2017 planned for the establishing of a fund, with an allocation of €1 900 million for the year 2017, €3 150 million for the year 2018, €3 500 million for the year 2019, and €3 000 million for each of the years from 2020 to 2032, to ensure the funding of investments and infrastructure developments across the country in spending areas relating to, among other things, transport, road systems, sustainable mobility, road safety, upgrading and accessibility of railway stations.

Modal shift in the field of goods transport

In general, it is increasingly clear that steps should be taken to interlink the medium and long distances that have to be covered by rail or boat with local distribution to businesses, distribution centres, commercial areas and cities that has to be covered by road using means of transport that are clean and have a low environmental impact. There must be efficient distribution along the logistical chain, with public and private hubs (ports, freight terminals, railway stations, mass retail channels, industrial districts) connected to the railway, motorway and local network.

- **Marebonus**

The Marebonus provides for incentives to be given to road transport companies for adopting combined road-sea modes of transport.

- **Ferrobonus**

The Ferrobonus provides for incentives to be given to road transport companies for adopting combined road-rail modes of transport.

- **National Logistics Platform**

The development of the National Logistics Platform will be continued, aimed at providing services to all logistics and transport operators, with the objective of optimising processes through an increase of interconnection and facilitation of data management.

Modal shift in the field of transport of persons

Measures for mobility management:

- development of mobility for cyclists through cycle paths;
- promoting shared mobility (bike, car and motorbike sharing with low or zero

- emissions);
 - integration between sustainable mobility services (for example, parking structures for bicycles or car and bike sharing services close to public transport stops) and interchange parking;
 - promotion of smart working tools;
 - promotion of car-pooling;
 - development of ITS (traffic management, infomobility, smart roads).
 - Electric Road System (ERS): promotion, on the basis of the trials launched, of initiatives for potential electrification of the motorway network using ERS technologies that enable the use of hybrid vehicles for transporting goods or passengers, through conductive or inductive systems (eHighway technology).
- **Sustainable urban mobility plans (SUMP)**

These are described in section 3.2, together with the other planned measures for promoting sustainable mobility.

iv. Where applicable, national policies, timelines and measures planned to gradually phase out energy subsidies, in particular for fossil fuels

The importance of an intervention aimed at rationalising and eliminating subsidies has been emphasised several times at various G20 summits held since 2009. In fact, at the G20 summit in Pittsburgh in 2009, the countries committed to rationalise and eliminate inefficient subsidies for fossil fuels in the medium term, which encourage waste.

In implementing this undertaking, from 2015, G20 launched a voluntary programme for peer review of national reports into fossil fuel subsidies (two countries per year: one with an advanced and one with an emerging economy). The exercise involved China and the USA in 2016 and Mexico and Germany in 2017. Italy agreed to be subject to the peer review by G20 producing a report on fossil fuel subsidies in 2018, in parallel with Indonesia.

From an economic and environmental point of view, all fossil fuel subsidies are inefficient, in that they do not internalise the impact on the environment and on human health, and they constantly violate the 'polluter pays' principle. From a social point of view, some of these subsidies play an important role in defending social groups in difficulty or economic sectors which are vulnerable or exposed to international competition. However, as indicated by numerous international organisations, including for example the OCSE, it is possible to use economic instruments to help the most deprived sections of the population or production sectors deserving of support, leaving the price signal for energy and natural resources unchanged.

It is clear that, in order to reach the target in the Paris Agreement to keep the global average temperature rise to below 1.5°C, it is vital that all countries proceed to eliminate fossil fuel subsidies (in particular petrol, natural gas and carbon), both direct and indirect.

Additionally, at G7 at Ise-Shima in 2016, the countries identified the deadline of 2025 for phasing out the principal fossil fuel subsidies, inviting all countries to follow the example of the undertaking to phase out fossil fuel subsidies that the European Commission planned by 2020 in the Roadmap to a Resource Efficient Europe.

The G7 Environment summit held in Bologna under the Italian presidency on 12-13 June 2017 reiterated the undertaking, and the G7 countries acknowledged the importance of 'benefits

deriving from monitoring progress made towards the phasing out of incentives, including subsidies, that are not consistent with sustainability objectives' and support 'all countries interested in exploring approaches that allow a better alignment of tax systems with environmental targets'.

In Italy, a step in the right direction is represented by the creation of the 'Catalogue of environmentally harmful and environmentally beneficial subsidies', requested by Parliament from the Ministry of Environment, an informative document for identifying those subsidies that damage or benefit the environment, thus suggesting areas of intervention and reform in order to reach the sustainable development targets provided by the 2030 Agenda and the climate targets provided by the Paris Agreement, enabling new financial resources to be made available for investment in the sustainable development of the country.

Once those environmentally harmful subsidies have been identified, those that can be eliminated or reduced can be pinpointed, also in the light of EU regulations, accounting rules and the technical opinions of the Ministry of Economic Affairs and Finance, the Ministry of Agricultural, Food, Forestry and Tourism Policy, Ministry of Economic Development, the Ministry of Infrastructure and Transport and the Ministry of the Environment and Protection of Natural Resources and the Sea. The aim is to enable production tools to be modernised and the creation of new innovative businesses and markets to be incentivised. In making this change, industrial sectors and citizens must be given clear goals and medium- and long-term milestones. In cases of reconversion of polluting or obsolete equipment, for example, the change will be made using the time frames set out in the amortisation plans of the sectors in question.

Thanks to the identification of the subsidies, however, it is possible to develop new tax reform proposals which shift the tax burden away from labour and companies and onto activities that pollute and exploit natural resources, as advocated by the major international organisations.

According to the government study, there are several routes that may be taken. Some subsidies are relatively easy to reform; others need more in-depth work; some require agreements at a European level (for example those relating to differentiation of VAT, free ETS allowances) or on a global level (for example, fuel tax exemptions for international air and maritime travel, linked to the ICAO and IMO conventions).

Among the many proposals being assessed, there is the possibility of a progressive, gradual reduction of environmentally harmful subsidies in the energy sector, with the reuse of the revenue recovered to reinvest, at least in part, in compensating and encouraging the ecological energy transition in the sectors directly involved and to compensate the economic actors who benefit from these subsidies in order to create greater social acceptability of their reduction/elimination. As an alternative, the recovered revenue may be used to invest in projects to combat climate change, to reduce the tax wedge on labour and capital income, or to reduce public debt. It is however emphasised that the financial assessment carried out may not correspond to the potential income that the government could collect or save if fossil fuel subsidies are phased out.

In June 2019 the 'Action plan for improving air quality', containing measures to reduce polluting emissions with a focus on transport, agriculture and domestic heating, was signed by the Prime Minister's Office, six ministries (the Ministry of Economic Affairs and Finance, the Ministry of Agricultural, Food, Forestry and Tourism Policy, Ministry of Economic Development, the

Ministry of Infrastructure and Transport, the Ministry of the Environment and Protection of Natural Resources and the Sea and the Ministry of Health), and the Regions and Autonomous Provinces.

Action 1 of the cross-cutting measures contained in the memorandum provides for environmentally damaging subsidies to be cut back, by:

- setting up, within 90 days, an interministerial working group, with the participation of the Regions, coordinated by the Ministry of Economic Affairs and Finance to verify the socio-economic impact of environmentally damaging subsidies and identify those which are not necessary;
- drawing up, by 31 December 2019, and presenting to stakeholders legislative proposals for cutting back on environmentally damaging subsidies and using the related resources for implementing air quality improvement measures.

The Budget Law for 2020 provides that, by 31 January 2020, a Commission be set up within the Ministry of the Environment and Protection of Natural Resources and the Sea to study and draw up proposals for ecological transition and for the reduction of environmentally damaging subsidies.

The same Law restructures and raises levies on energy products used to produce electricity with the specific aim of introducing specific rates of excise duties determined on the basis of greenhouse gas and fine dust emission levels. The increase, which applies to all fossil fuels, is particularly high for coal, coke and lignite. The extension envisaged for non-chemically modified vegetable oils remains in place.

3.2 Dimension energy efficiency

Planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030 as well as other objectives referred to in point 2.2, including planned measures and instruments (also of a financial nature) to promote the energy performance of buildings, in particular with regard to the following:

i. energy efficiency obligation schemes and alternative policy measures under Articles 7a and 7b and Article 20(6) of Directive 2012/27/EU and prepared in accordance with Annex II to this Regulation

In order to achieve the minimum cumulative end-use energy saving to be attained in the period 2021-2030 within the meaning of Article 7 of the EED, confirmed at 51.4 Mtoe, compared with 50.98 Mtoe calculated on the basis of average end-use energy consumption in 2016-2018, Italy will use the set of requirements based on White Certificates and a set of alternative measures that are already in place, to be revised and strengthened in the next few years in order to reach the targets set.

As the consultation on the draft INECP showed, to improve the efficiency of the support mechanisms in place the tools need to be better tailored to each sector and measure, in order to avoid measures overlapping and competing with one another and to focus resources, facilitate access and maximise savings.

In particular, the instruments in place expressly dedicated to the promotion of energy efficiency and monitored for the purposes of achieving the savings target pursuant to Article 7 of the EED are the following:

- the White Certificates scheme;
- tax deductions for energy-efficient measures and restoration of existing buildings;
- the 'Conto Termico';
- The National Fund for Energy Efficiency;
- Industry 4.0
- programme for upgrading the energy efficiency of central government buildings (PREPAC);
- programme of energy efficiency measures under the cohesion policies 2021-2027;
- national energy efficiency information and training plan (PIF)
- a set of sustainable mobility measures including:
 - renewal of the fleet of local public transport vehicles;
 - measures for the modal shift in goods transport;
 - other measures still to be assessed in terms of savings in the transport sector (renewal of goods and private vehicle fleet, modal shift in passenger transport and development of transport infrastructure).

All of the above measures, already operational or in the process of being launched at a national level, are summarised in the following sections, including for each one an estimate of expected savings and the resources needed to meet all of the objectives on sectoral saving described in section 2.2.

The savings estimated from the above-listed measures is based on the assumption that they will function and be funded until 2030.

As mentioned above, in Italy numerous measures for promoting energy efficiency, in the transport sector in particular, are in place or planned. These can be monitored and reported on following the analyses currently under way.

Please refer to Annex III of Regulation (EU) 2018/1999 on Governance of the Energy Union (in which the measures and methods adopted by the Member states for applying Article 7 of Directive 2012/27/EU are made public) for more information and details on the individual measures described below (beneficiaries, who is involved in and responsible for implementation, admissible interventions, methods for calculating savings, monitoring, verification and auditing).

- **White Certificates**

For a description of the measure, please refer to the report submitted in accordance with Annex III of Regulation (EU) 2018/1999 on Governance of the Energy Union.

Development trends

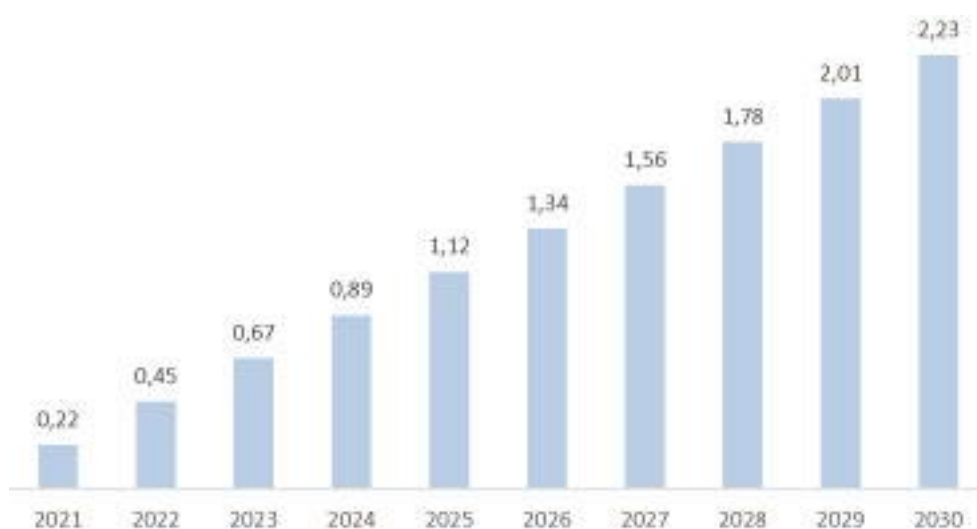
The process for updating and reinforcing the White Certificates will be continued with a view to simplifying the scheme and optimising the methodologies for quantifying and recognising energy savings, and reducing the time frames for approval, issuance and supply of certificates on the market. These aspects, which also came up in the public consultation, are fundamental for the effective continuation of the measure in 2020-2030.

The possibility of implementing a radical reform of the scheme is being examined. Points being analysed include the potential expansion of the category of obligated parties and the potential modification/integration of the White Certificates market scheme with other complementary ones. Regarding admissible measures, it will be crucial to effectively promote the measures in the civil and transport sectors, including by developing behavioural measures. In line with the outcome of the public consultation, more support will also be dedicated to the training and information stages by distributing, for the various sectors and interventions, guides, databases with predefined baselines and approved best practices. Furthermore, there will be more focus on supporting operators. These last aspects are key to effecting the necessary improvements to the quality of the projects submitted, which will also relieve some of the administrative burden on GSE.

Estimate of energy and economic indicators

In order to estimate the contribution of the White Certificates to the savings targets fixed by Article 7(1) of Directive 2012/27/EU, end-use energy savings, estimated to be generated by new projects implemented from 1 January 2021 and which will continue to generate benefits up until 31 December 2030, will be calculated. In the following figure, an estimate is given of annual generation of these savings of around 12.3 Mtoe of cumulative end-use energy.

Figure 30 - Annual savings of end-use energy expected from new measures promoted with the White Certificates scheme (Mtoe)



In terms of investment raised to generate the aforesaid savings, this is estimated at around €111.2 billion in the period 2021-2030, compared with a budgetary commitment for the State for the promotion of the measures carried out estimated at €5.6 billion.

- **Tax deductions for energy-efficient retrofitting and restoration of existing buildings**
- **Description of the measure**

For a description of the measure, please refer to the report submitted in accordance with Annex III of Regulation (EU) 2018/1999 on Governance of the Energy Union.

Expected development trends

A tax deduction scheme for the energy-efficient retrofitting and restoration of existing buildings, to run for three years, is currently being assessed.

In order to strengthen the measure, maximise results and optimise resources, the plan is to integrate the Ecobonus, Sismabonus and Bonus Casa schemes into a single mechanism. The scheme will provide a benefit scalable in relation to the expected saving, based on the total technical life of the measure, for works to improve buildings' energy performance. The aim is to reward the most cost-effective interventions and to increase the trend towards deep renovation, including the earthquake proofing of buildings.

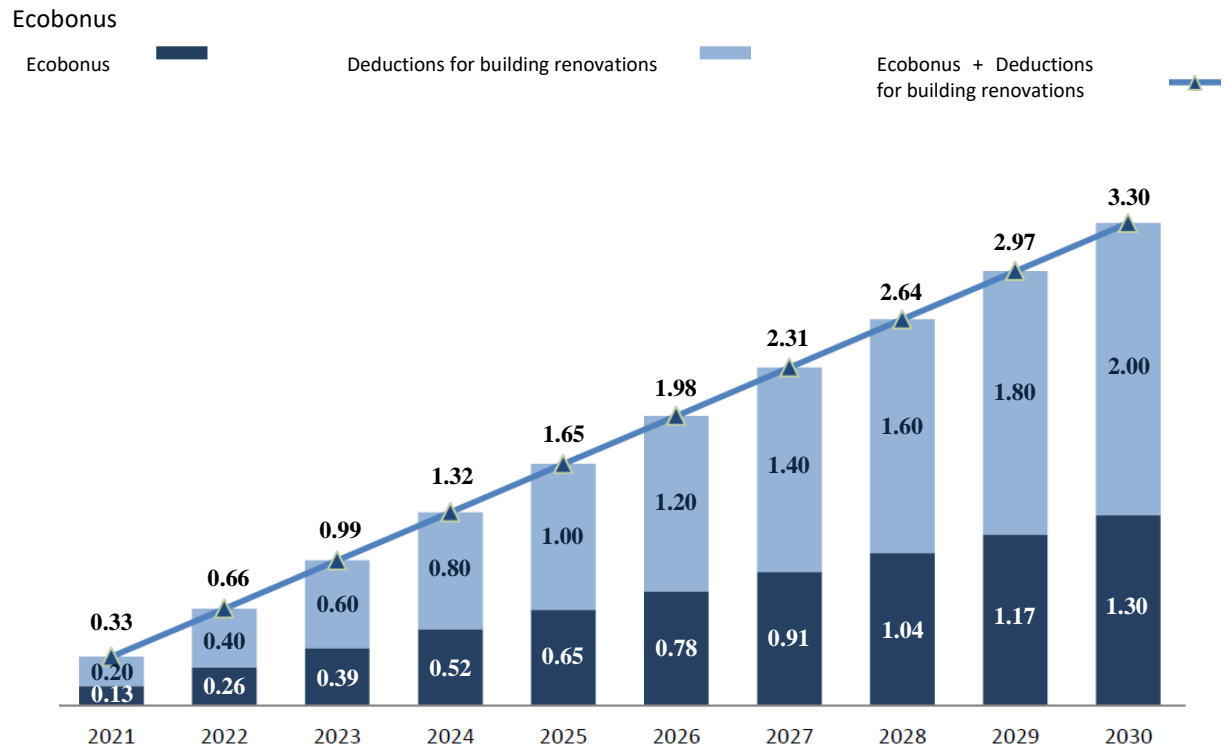
Lastly, pursuant to Article 1(3)(a) of the Budget Law for 2018, an implementing provision is being drafted for the creation of a specific segment in the National Energy Efficiency Fund for providing guarantees to credit institutions that issue loans to private persons or joint-owners of housing blocks for the purpose of improving the energy efficiency of their part of, or the whole, building, in synergy with the tax schemes described. This measure will help overcome one of the barriers to the implementation of energy-efficient retrofitting: initial investment.

Estimate of energy and economic indicators

The results obtained through the implementation of the instrument to date have been significant and allow estimation of the saving potential of the scheme in future years and up to 2030. The figure below shows the estimated annual savings achievable up to 2030.

The overall contribution of the measure to the above targets is around 18.15 Mtoe of cumulative end-use energy.

Figure 31 - Anticipated savings for tax deductions (Mtoe)



In terms of investment raised to generate the aforesaid savings, this is estimated at around €82.5 billion in the period 2021-2030, compared with a budgetary commitment for the State for the promotion of the measures carried out estimated at €45.4 billion.

- **Conto Termico:**

For a description of the measure please refer to the report submitted in accordance with Annex III of Regulation (EU) 2018/1999 on Governance of the Energy Union.

Expected development trends

As the results of the public consultation showed, to avoid fragmentation and overlapping of instruments for promoting energy efficiency, the plan is to focus the Conto Termico scheme on energy-efficient retrofitting and restoration of non-residential buildings, in the public and private tertiary sector. The intention is to continue the task of simplifying access to the scheme for public bodies, also through promotion of the ESCo model and the use of energy performance contracts (EPCs). In addition, the possibility of extending the admissibility of interventions, including measures to connect to efficient district heating systems, will be explored.

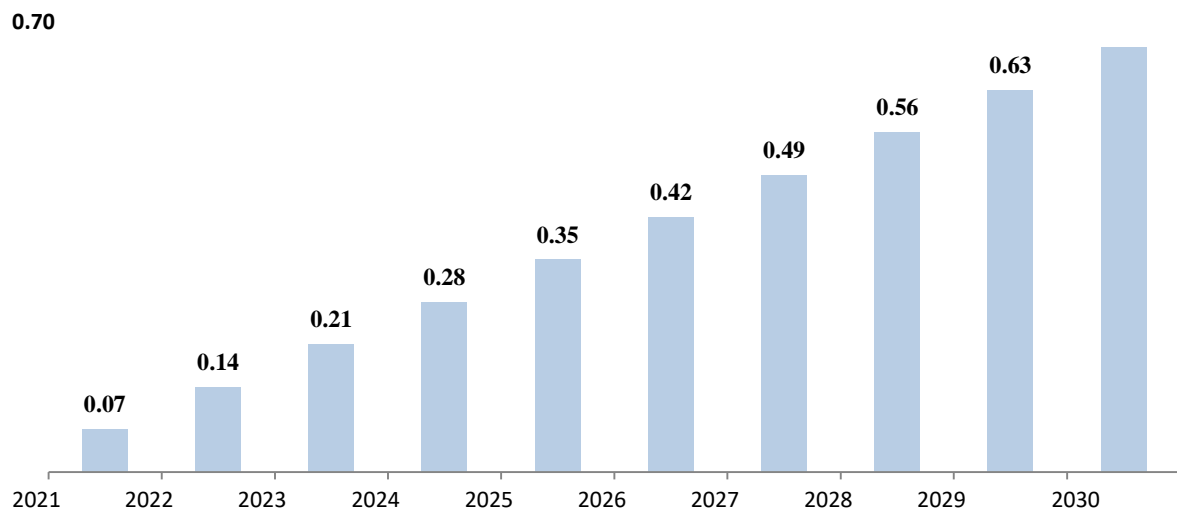
Estimate of energy and economic indicators

In the period of operation of the Conto Termico, a growing trend has been observed that saw the first significant results attributable to the scheme in 2016, a year in which there was an increase of 81% in applications received in relation to 2015, which corresponds to an increase of 80% in incentives applied for. In 2017, the increase in applications received was as high as 289% in relation to the preceding year, confirming an extremely positive trend in favour of the scheme, particularly concerning applications submitted by public bodies.

The results obtained through the implementation of the instrument to date allow estimation of the saving potential of the scheme in future years and up to 2030. The figure below shows the estimated annual savings achievable up to 2030.

The overall contribution of the measure to the above targets is around 3.85 Mtoe of cumulative end-use energy.

Figure 32 - Anticipated end-use savings for the Conto Termico (Mtoe)



In terms of investment raised to generate the aforesaid savings, this is estimated at around €17.5 billion in the period 2021-2030, compared with a budgetary commitment for the State for the promotion of the measures carried out estimated at €7.5 billion.

- Italian National Fund for Energy Efficiency**

Description of the measure

For a description of the measure please refer to the report submitted in accordance with Annex III of Regulation (EU) 2018/1999 on Governance of the Energy Union.

Anticipated development trends

In order to increase the capacity of the Fund to promote energy-efficient measures, the financial allocation currently available will be increased, favouring the payment of resources dedicated to energy efficiency managed by central and local public bodies (structural funds, European investment funds) and directing the scheme towards the promotion of measures in the civil sector (both the housing and tertiary sectors) and the transport sector.

To this end, in 2019 part of the resources of the Italian Fund for investments and the development of infrastructure, established by the Budget Law for 2017 and refinanced by the Budget Law for 2018, have gone towards increasing allocations for the National Fund for

Energy Efficiency. For 2021-2030 the additional funding mentioned above will be €733 million.

As the results of the public consultation indicate, projects should be pooled together using investment groups or platforms. It will also be important to provide for information-dissemination activities to increase awareness of the instrument and its usability.

In addition, as previously mentioned in the section on tax deductions, a new section of the fund is being created that will be used to offer guarantees for financial institutions funding energy-efficient retrofitting.

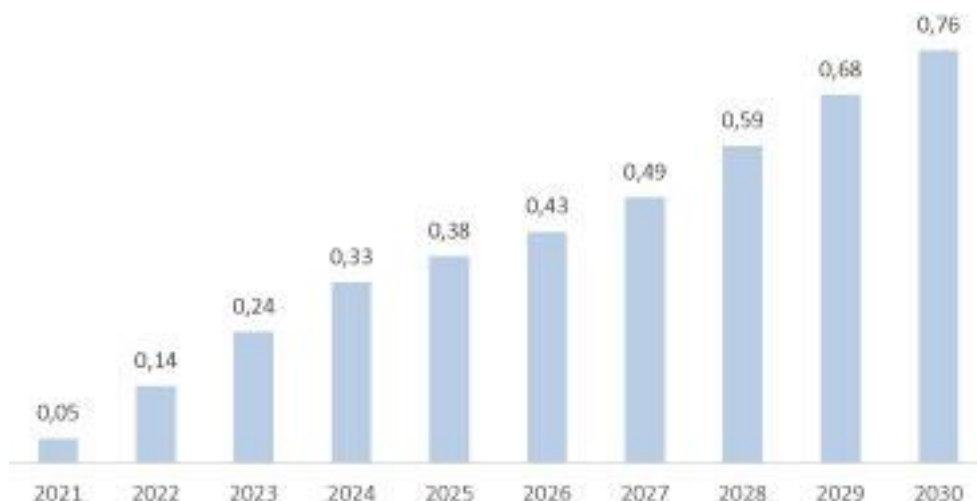
Lastly, consideration will be given to broadening the types of financial and economic support offered by the Fund, in order to maximise the effectiveness of the available resources.

Estimate of energy and economic indicators

The Fund became operational in March 2019.

As operational results from previous periods are not available, the estimate of additional annual savings due to new measures is carried out on the basis of a mix of the measures planned by the Fund and the resources that the law makes available. The figure below shows the estimated annual savings achievable up to 2030. The overall contribution of the measure to the above targets is around 4.09 Mtoe of cumulative end-use energy.

Figure 33 - Anticipated end-use energy savings for the National Fund for Energy Efficiency (Mtoe)



In terms of investment raised to generate the aforesaid savings, this is estimated at around €4.4 billion in the period 2021-2030, compared with a commitment from the State to increase the allocation to the Fund to €80 million a year in the same period.

• Industry 4.0

For a description of the measure, please refer to the report submitted in accordance with Annex III of Regulation (EU) 2018/1999 on Governance of the Energy Union.

Expected development trends

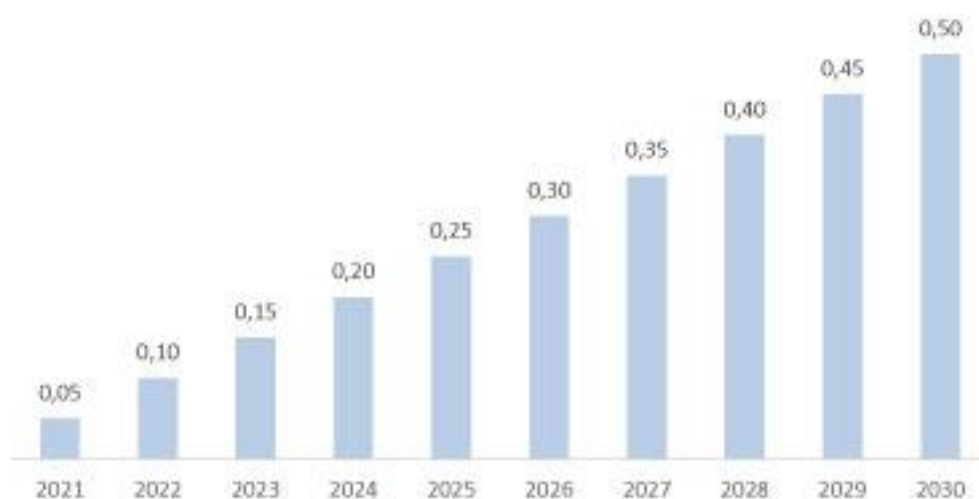
The Budget Law for 2020 (Law No 160 of 27 December 2019) changes the existing regulations governing Industry 4.0, introducing a new tax credit for expenses incurred in investing in new capital goods. The provision applies to all businesses and, for certain investments, also to professionals. The tax credit is granted at a differentiated rate according to the type of goods invested in. It covers investments in new capital goods, including

intangible assets that are used for technological transformation under the Industry 4.0 model.

Estimate of energy and economic indicators

For energy efficiency interventions carried out in accordance with Industry 4.0, a cumulative saving of 2.8 Mtoe in 2030 in end-use energy is estimated, assuming that the Industry 4.0 measures described above remain active until 2030.

Figure 34 – Savings in end-use energy expected under Industry 4.0 (Mtoe)



Investments made in order to create the above-mentioned savings are expected to total around €2.5 billion in 2021-2030, against an estimated State commitment of expenditure of €0.5 billion for promoting the interventions.

• Programme for upgrading the energy efficiency of central government buildings (PREPAC)

For a description of the measure, please refer to the report submitted in accordance with Annex III of Regulation (EU) 2018/1999 on Governance of the Energy Union.

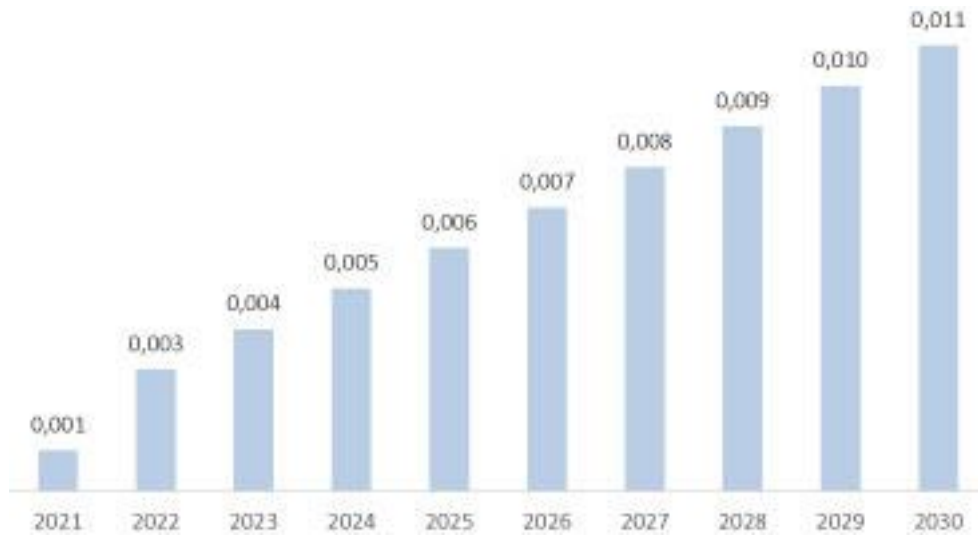
Expected development trends

Funding for the measure will cover 2021-2030 and updating and strengthening measures will be implemented in order to simplify administrative procedures. The aim is to draw on the synergies between the public bodies involved in managing the scheme and enable adequate management IT support to be developed.

Estimate of energy and economic indicators

Energy efficiency interventions carried out in accordance with PREPAC are expected to result in a cumulative saving of 0.1 Mtoe of end-use energy by 2030, originating from new projects implemented from 1 January 2021.

Figure 35 – Expected annual end-use energy savings under PREPAC (Mtoe)



Investments made in order to create the above-mentioned savings are expected to total around €0.32 billion in 2021-2030, against an estimated State commitment of expenditure of €0.29 billion for promoting the interventions carried out.

• **Cohesion policies**

For a description of the measure, please refer to the report submitted in accordance with Annex III of Regulation (EU) 2018/1999 on Governance of the Energy Union.

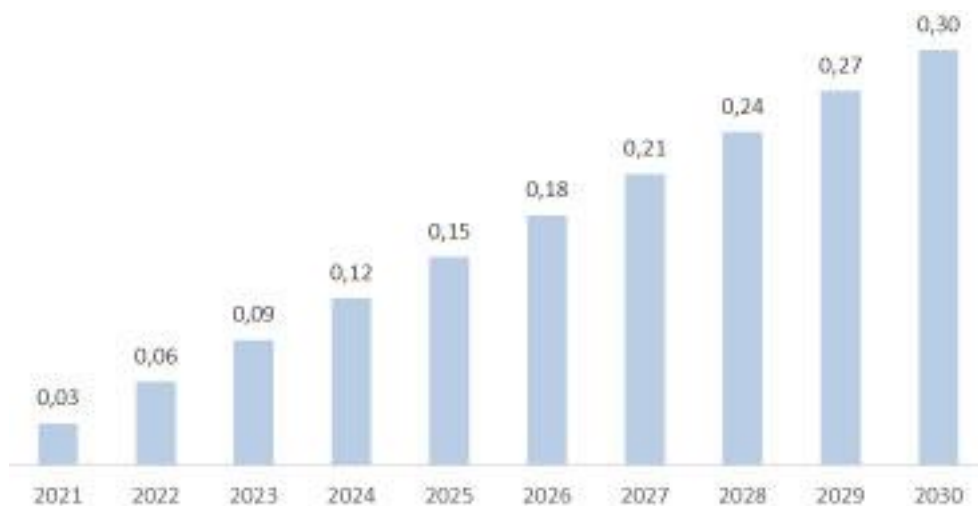
Expected development trends

For the guidelines please refer to the guidance on investments financed by the 2021-2027 cohesion policy for Italy contained in Annex D of the Commission’s Country Report of 27 February 2019, as cited in Annex III of Regulation (EU) 2018/1999 on Governance of the Energy Union.

Estimate of energy and economic indicators

The energy efficiency interventions facilitated by the cohesion policies are expected to result in a cumulative saving of 1.7 Mtoe of end-use energy by 2030.

Figure 36 - Expected annual end-use energy savings under the cohesion policies (Mtoe)



- **Information and training programmes for consumers**

Description of the measure

For a description of the measure, please refer to the report submitted in accordance with Annex III of Regulation (EU) 2018/1999 on Governance of the Energy Union.

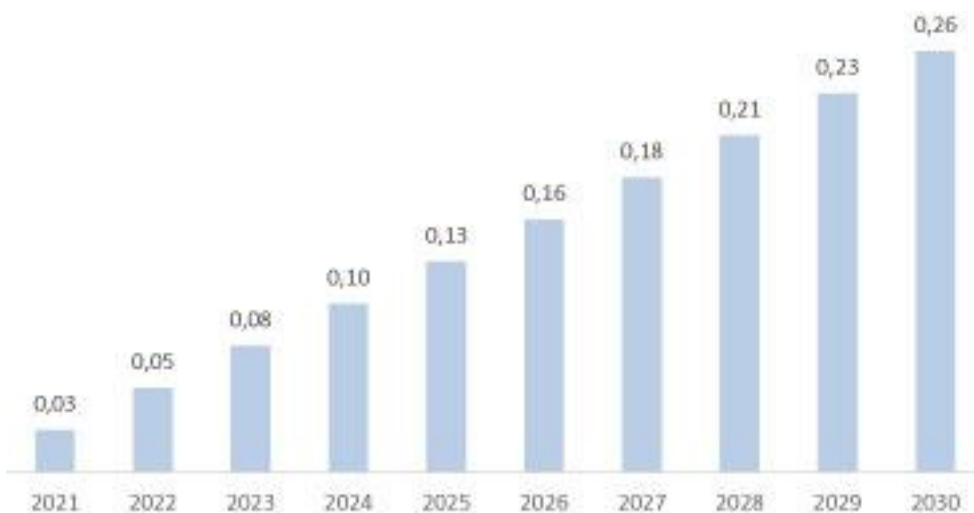
Expected development trends

From 2021 to 2030 more importance will be placed on information-sharing and training activities, and the launch of a potential new programme based on experience gained as a result of the one coming to a close will be assessed. The theme of monitoring the savings generated by awareness-raising programmes will be explored, with a view to offering evermore robust support to decision-making in that area, as well as to meeting the energy efficiency targets.

Estimate of energy and economic indicators

Energy efficiency interventions carried out under the information and training programmes for consumers are expected to lead to cumulative savings of 1.4 Mtoe of end-use energy by 2030.

Figure 37- Expected end-use energy savings under the information and training programme (Mtoe)



Measures in the transport sector

There are many national and local measures in place in the transport sector aimed at reducing consumption and emissions. In this section are listed, by type of target, the principal measures that contribute and will contribute to achieving the energy efficiency and decarbonisation targets in the coming years. More information on this is contained in the report submitted in accordance with Annex III of Regulation (EU) 2018/1999 on Governance of the Energy Union, sent alongside the final version of this Plan.

In particular, in order to reach the minimum target for energy saving set by Article 7(1)(b) of the EED, Italy is focusing on two different measures:

- Replacement of the fleet of vehicles for local public transport;
 - Interventions for the modal shift in goods transport.
- **Replacement of the fleet of local public transport vehicles**

Description of the measure

For a description of the measure, please refer to the report submitted in accordance with Annex III of Regulation (EU) 2018/1999 on Governance of the Energy Union.

Expected development trends

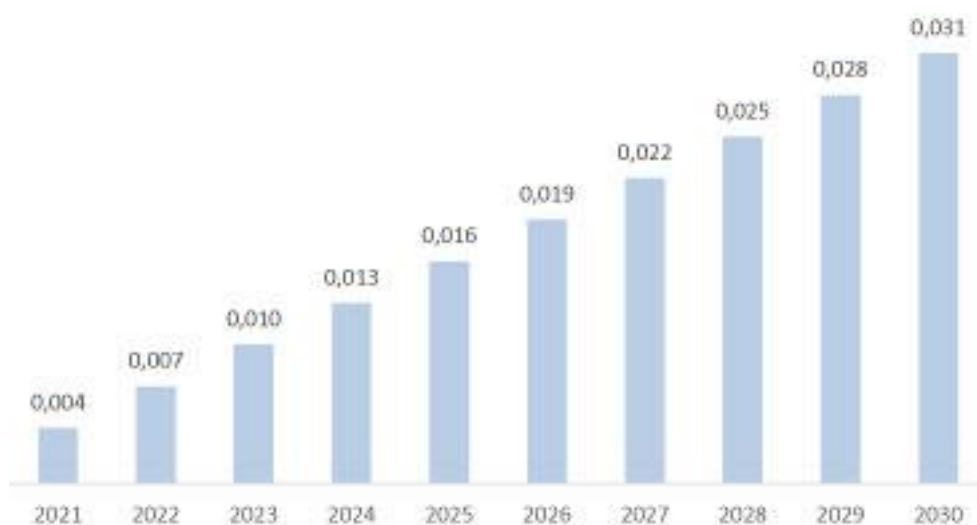
It is proposed to accelerate the provisions set out in paragraph 10 of Article 18 of Italian Legislative Decree 257/2016 (transposition of the DAFI directive) stipulating that the public administration, the Regions, local bodies and providers of public utilities for activities carried out in the provinces with high levels of PM10 particle pollution, when replacing their respective fleets of cars, buses and public utility vehicles, including those for collecting urban waste, must ensure that 30% by 2022, at least 50% by 2025 and 85% by 2030 of new vehicles purchased are electric vehicles and hybrid vehicles with off-vehicle charging, powered by methane and hydrogen, and electricity and methane in the case of buses. In the case of replacing transport fleets used for local public transport, this limit applies solely to urban services. The percentage is calculated using purchases planned on a triannual basis from the reference data. For the law to be effective, additionally, it will remain the case that public tenders which do not comply with this provision are void.

Law No 141 of 12 December 2019, converting Decree-Law No 111 of 14 October 2019, introduced measures for the replacement of vehicles for local public transport (LPT). The decree authorises expenditure of €10 million for each of the years 2020 and 2021. The funding is intended to finance the investments necessary to implement experimental projects introducing hybrid or electric vehicles into the school transport service. Beneficiary schools will be state and municipal infant schools and state schools during the first teaching cycle. The measure is restricted to municipalities or groups of municipalities with populations of over 50,000 that are affected by EU infringement proceedings No 2014/2147 of 10 July 2014 and No 2015/2043 of 28 May 2015 for non-fulfilment of the obligations set out by Directive 2008/50/EC on air quality; they are linked to specific geographical areas. The measure is funded by a portion of the revenues from CO2 emission quota auctions, earmarked for the Ministry of the Environment and Protection of Natural Resources and the Sea and deposited by GSE into the relevant Chapter of the State Budget. Using this funding source and with application only to the above-mentioned municipalities, Law No 141 of 12 December 2019 provides for the allocation of €20 million for each of the years 2020 and 2021 for projects to create, modernise and upgrade reserved lanes for LPT.

Estimated energy and economic indicators

The planned measures for the replacement of public vehicles used for the transport of persons are expected to generate cumulative savings of 0.2 Mtoe of end-use energy by 2030.

Figure 38 - Annual savings in end-use energy expected from the replacement of the local public transport fleet (Mtoe)



- Modal shift in goods transport

Description of the measure

For a description of the measure, please refer to the report submitted in accordance with Annex III of Regulation (EU) 2018/1999 on Governance of the Energy Union.

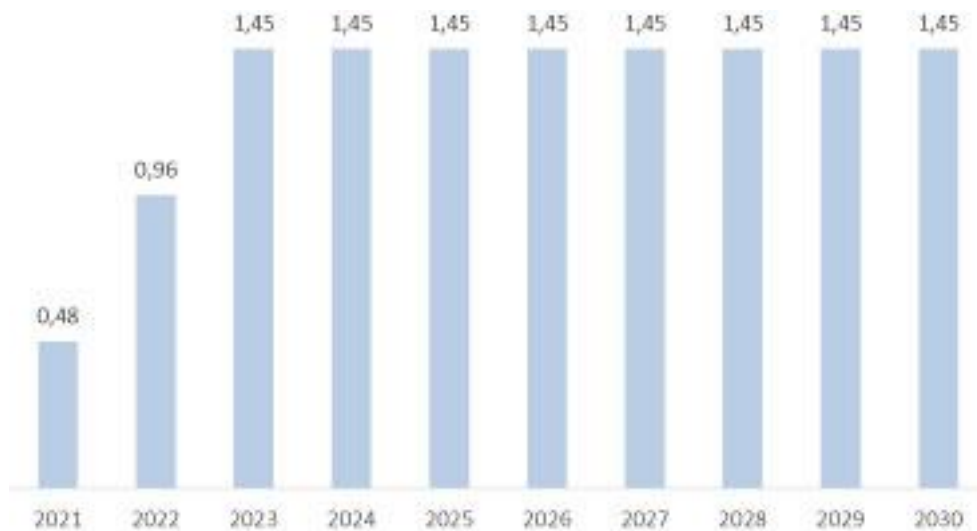
Expected development trends

Marebonus and Ferrobonus are fundamental measures for improving energy efficiency in the transport sector, because the modal shift is a highly effective measure in terms of the cost to benefit ratio. It will therefore be important to relaunch them for 2021-2030, to update and reinforce them on the basis of experience gained, and to monitor the resulting energy savings more effectively. Decree-Law No 124 of 2019, converted into Law No 157 of 19 December 2019 and providing for measures to improve the environment and promote the development of more sustainable forms of goods transport, authorises expenditure of €2 million for 2020 and €5 million for each of the years 2021 and 2022, to improve goods transport on inland waterways and river and sea routes.

Estimated energy and economic indicators

The measures put in place to encourage the modal shift in goods transport are expected to result in a cumulative end-use energy saving of around 13 Mtoe by 2030.

Figure 39 – Annual end-use energy savings expected from modal shift in goods transport (Mtoe)



- Other measures to promote sustainable mobility

Below is a list of further measures to encourage sustainable mobility in terms of incentives and infrastructure, as well as decarbonisation and a behavioural change in the transport sector. However, these measures were not taken into account in the estimate of energy savings for the purpose of reaching the minimum target set out in Article 7(1)(b) of the EED.

- **Replacement of private vehicles used for the transport of persons**

With Law No 134 of 2012, Italy gave impetus to the development of mobility with low-emission vehicles. The law in fact provides, among other things, for the preparation of a National Infrastructure Plan for Charging Electric Vehicles (PNIRE) which provides guidance for a plan on a national level to ensure homogeneous distribution across the whole country of an integrated and interoperable network.

Therefore, even before the publication of European Directive No 94/14, the PNIRE (Italian Prime Ministerial Decree of 26 September 2014) had been approved, subsequently updated with Prime Ministerial Decree of 18 April 2016 (currently in force).

The subject of the Plan is the creation of infrastructure networks for charging electric vehicles and measures for the restoration of buildings aimed at the development of said networks.

The Plan, other than clarifying the concept of charging services, has implemented the provisions of Italian Law No 134 of 2012 relating to funding for creating charging networks on a national level, allocating around €33 million in two phases:

PHASE ONE: The Italian Ministry of Infrastructure and Transport, by means of a call for tender addressed to all Regions, has assigned, with Ministerial Decree No 469 of 7 November 2014, around €4.5 million to projects aimed at creating infrastructure in the main urban areas of the country characterised by high levels of traffic congestion.

The installation of around 700 charging points is planned by way of these projects, in over 100 municipalities in Italy. To date, 50% of the recharging points have been installed.

The projects have also enabled the launch of the first communication and information actions on a national scale concerning policies dedicated to electric mobility. To this end, it seems necessary to bring all the national and regional initiatives on electric mobility and the

recognition of recharging infrastructure under the PNIRE together under one system and to provide for strengthening and concentrating the available resources on strategic projects to develop the national recharging network.

PHASE 2 - With Prime Ministerial Decree of 1 February 2018, the Programme Agreement between the Italian Ministry of Infrastructure and Transport and the Regions and the autonomous provinces was approved, aimed at identifying programmes for creating widespread charging networks on national territory aimed at promoting the proliferation of electric vehicles.

With this agreement, the Ministry is making available around €28 million, to which further funding from the Regions is to be added, from a minimum of 50% to a maximum of 65%, which brings the investment plan to an estimated value of more than €70 million in total.

Specifically, with this funding the Ministry is supporting local bodies in the implementation of charging networks in metropolitan and non-metropolitan areas in the following four ways, considered priorities for development of electric mobility, also in view of the examples of the principal experiences on a Community and international level, which have focused mobility policies on the incentive of zero-emission forms of mobility:

- a. public charging infrastructures;
- b. fuel distribution installations;
- c. private charging infrastructures accessible to the public (garages, multi-storey car parks etc.);
- d. domestic charging infrastructures.

In addition, in validating several projects as part of the CEF call for proposals, which plan for the creation of infrastructure for TEN-T road and motorway networks, the Ministry is monitoring and coordinating the creation of over 300 fast (and ultra-fast) charging stations at fuel dispensers at roadside and motorway service stations.

The PNIRE is currently being updated using an integrated approach that takes into account other measures for sustaining demand for electric vehicles and increasing the usability of the infrastructure.

The possibility of coordinating the development of recharging infrastructure with plans to rationalise fuel networks is also being explored.

The Italian government then intends to promote a progressive reduction of motor vehicles with diesel and petrol engines, in order to limit polluting emissions and to meet the targets on climate change given in the Paris Agreement. For this purpose, the plan is to gradually review the tax system on transport (registration tax, ownership tax, taxes on fuel etc.). A potential review of the ownership tax so that it is determined on the basis of the actual use of the vehicle will be explored in the framework of the debate on the issue at EU level. Further methods of financing for promoting low-emission vehicles will also be examined. The first public contributions to purchasing vehicles with very low CO₂ emissions have been introduced (see section 3.1.3, point iii).

In addition, Law No 145 of 30 December 2018 (the Budget Law for 2019), as amended by Decree-Law No 34 of 30 April 2019 (the Growth Decree-Law) established that anyone who, in 2019, bought, including via leasing, and registered in Italy a new electric or hybrid vehicle in category L1e, L2e, L3e, L4e, L5e, L6e or L7e and who took for scrapping a vehicle in one of those categories that they had owned or held for at least 12 months was entitled to a subsidy of 30% of the purchase price, up to a maximum of €3,000 in the event that the vehicle taken

for scrapping belonged to EURO category 0, 1, 2 or 3. This also applies if the vehicle had been owned or held for at least 12 months by a cohabiting family member.

The rules for applying the incentive were established by the Ministry of Economic Development in a Ministerial Decree of 20 March 2019.

Law No 141 of 12 December 2019, converting Decree-Law No 111 of 14 October 2019, establishes a fund for the 'Mobility Voucher' experimental programme with an allocation of €5 for 2019, €70 million for 2020, €70 million for 2021, €55 million for 2022, €45 million for 2023 and €10 million for 2024. The measure applies only to residents of the municipalities subject to infringement proceedings No 2147/2014 of 10 July 2014 and No 2043/2015 of 28 May 2015 for non-compliance of Italy with the obligations set out in Directive 2008/50/EC, who scrap type-approved passenger vehicles up to EURO category 3, or type-approved motorcycles up to EURO category 2 and EURO category 3 two-stroke motorcycles. They will receive a 'Mobility Voucher' of €1,500 per passenger vehicle and €500 per motorcycle scrapped. The vouchers can be used within three years to buy local or regional public transport season tickets or bicycles, including e-bikes. The tickets can also be bought for cohabiting family members. The measure is funded by a portion of the revenues from CO2 emission quota auctions, earmarked for the Ministry of the Environment and Protection of Natural Resources and the Sea and deposited by GSE into the relevant Chapter of the State Budget.

Different pilot initiatives have been launched, such as for example the incentives for some areas of law enforcement to purchase electric or hybrid cars for surveillance in protected areas. Specifically, the intention is to provide a sum of €10 million for the purchase of around 220 electric or hybrid cars (around 80% for the military police and the remaining 20% for the port authorities), which will be used for surveillance and monitoring operations in protected natural areas. The initiative also assumes the importance of promoting the use of electric or hybrid cars, considering that protected natural areas are visited every year by over 100 million people.

The Budget Law for 2020 establishes that from January 2020, when public administrations purchase or hire at least two vehicles to replace their vehicle fleets, at least 50% of that purchase or hire must be for road transport electric, hybrid or hydrogen-powered vehicles, within the limits of the budget earmarked for that category of expenditure. In accordance with the EU rules on State aid, further resources of €3 million for 2020 are destined for the replacement of the vehicle fleet of companies operating in Italy and registered in the national electronic register.

The Budget Law for 2020 also envisages tighter rules, from July 2020, on fringe benefit taxes on newly registered highly polluting company cars. The tax decreases to 25% for company cars with CO2 emissions of below 60 g/km; it stays at 30% for those with emissions over 60 g/km and up to 160 g/km. For vehicles with emissions of over 160 g/km and up to 190 g/km, it increases to 40% (and 50% from 2021), whereas for all cars with emissions over 190 g/km it rises to 50% (and 60% from 2021).

Decree-Law No 124 of 2019, converted by Law No 157 of 19 December 2019 (the 2020 Decree-Law on Tax), extends the application of the very low VAT rate of 4% to the sale of hybrid and electric vehicles to persons with permanent reduced or impaired mobility or with hearing and/or visual impairments, and their families. The low rate also applies to the cost of garage services for adapting such vehicles to the needs of the drivers. Exemption from the

transcription tax, the additional provincial transcription tax and the registration tax to cover declarative or change of ownership documents is also provided for.

As regards regulatory measures, limits and rules will be introduced in relation to stopping, to access in certain areas and to parking that promote the use of vehicles with low CO₂ emissions or powered by renewable energy sources, including biomethane. Local regulatory initiatives will also be evaluated and reinforced, including, for example, limits on use of polluting vehicles in urban areas, with free access for alternative fuel vehicles and in particular electric vehicles in limited traffic zones, speed limits, priority lanes and car parks exclusively for zero-emission vehicles.

In particular, in Italian Legislative Decree No 257 of 16 December 2016 (transposing the DAFI Directive), Article 17(2) and Article 19(2) provide for the promotion of an agreement with the Regions for:

- ensuring implementation of consistent positions in terms of parking regulations, access to inner city areas, measures for incentivising and harmonising interventions and common objectives on national territory in relation to infrastructure networks for charging and refuelling of vehicles powered by electricity and other alternative fuels;
- ensuring homogeneous regulation for access to limited traffic areas for vehicles powered by alternative fuels and for their exclusion, subject to compliance with environmental protection constraints, from bans, including temporary bans, on road traffic.

- **Replacement of vehicles used for the transport of goods**

From the point of view of promoting development of commercial vehicles powered by alternative fuels, Ministerial Decree No 221/2018 from the Italian Ministry of Infrastructure and Transport also provided incentives for the year 2018 for the purchase of industrial vehicles powered by alternative gas fuel capable of transporting goods of overall mass with full load equal to or greater than 3.5 tonnes, with alternative drive systems powered by CNG methane, liquefied natural gas and electricity (full electric).

For this purpose, resources of around €33.6 million are to be used to promote initiatives for creating capital investment projects to replace vehicle fleets of haulage companies.

The Italian Ministerial Decree No 221/2018 identifies 4 homogeneous types of investment which are to receive a share of the resources, on the basis of agreements made with haulage associations and on the basis of historical data relating to the greater or lesser success that the same measures have achieved in previous years.

- €9.6 million are to be used for contributions to promote the purchase, including by means of leasing contracts, of new vehicles suitable for the transport of goods, of overall mass with full load equal to or greater than 3.5 tonnes, with an alternative drive system powered by CNG methane, liquefied natural gas or electricity (full electric) and for purchasing devices suitable for carrying out the conversion of vehicles for transport of goods with a combustion engine into electric vehicles and hybrid vehicles (electric-diesel);
- €9 million to remove more obsolete vehicles for scrapping with the purchase of new Euro 6 tractor units.
- €14 million for purchasing new semi-trailers for combined rail and/or maritime transport and equipment for vehicles used for transport under the ATP agreement (refrigerated transport) with low environmental impact;
- €1 million for purchasing of containers and swap bodies, considered to be standardised

intermodal loading units, along with semi-trailer container chassis.

- **Reinforcement of the infrastructure**

The Budget Law for 2017 planned for the establishing of a fund, with an allocation of €1 900 million for the year 2017, €3 150 million for the year 2018, €3 500 million for the year 2019, and €3 000 million for each of the years from 2020 to 2032, to ensure the financing of investments and infrastructure developments across the country in spending areas relating to, among other things, transport, road systems, sustainable mobility, road safety, upgrading and accessibility of railway stations. The fund was refinanced by the Stability Law for 2018, for €800 million for the year 2018, for €1 615 million for the year 2019, for €2 180 million for each of the years from 2020 to 2023, for €2 480 million for the year 2024 and for €2 500 million for each of the years from 2025 to 2033. Italian Ministerial Decree No 360 of 2018 provided for the distribution of the fund for the completion of rapid mass transport measures, allocating €1.4 billion for this purpose.

For the development of regional railways, following consultation with the Regions the Italian government will promote close cooperation with those Regions in monitoring the network, providing the possibility of entrusting to Rete Ferroviaria Italiana (RFI), the Italian railway infrastructure operator, several routes currently managed by the Regions.

For the development of the Electric Road System (ERS), on the basis of the results of trials the government will assess whether to launch initiatives for electrification of the motorway network using ERS technologies that enable the transfer of power to hybrid vehicles for transporting goods or passengers while moving, through conductive or inductive systems (eHighway technology).

With Italian Legislative Decree No 257/16, transposing Directive 94/14, measures were introduced in favour of development and distribution of electrical mobility, and in particular:

- measures aimed at promoting the deployment of charging infrastructure in buildings (Article 15 paragraphs 1 and 2);
- simplification of building authorisations through unequivocal recognition of declarations, statements, certifications and the technical documents to be presented for application for the necessary authorisation for the fitting of recharging infrastructures (Article 15 (4));
- introduction of the obligation for public bodies, organisations and institutions dependent thereon or controlled thereby, the Regions, local bodies and providers of public utilities controlled thereby, when replacing their respective fleets of cars, buses and waste collection vehicles, to purchase at least 25% of vehicles powered by CNG, LNG or electric vehicles (Article 18(10));
- modification of the Italian Highway Code on regulation of dedicated parking and stopping areas (Article 17 (1));
- providing for an agreement ensuring implementation of consistent positions in terms of parking regulations, access to inner city areas, measures for incentivising and harmonising interventions and common objectives on national territory in relation to infrastructure networks for charging and refuelling of vehicles powered by electricity (Article 17 (2));
- measures aimed at encouraging the installation of infrastructure for alternative fuels at new and renovated fuel distribution outlets (Article 18);
- a national map of points accessible to the public for the supply or recharging of alternative fuels, electricity or hydrogen for road transport vehicles, available on the

Ministry of Infrastructure and Transport's website. The map has been made possible thanks to information gathered using the 'single national platform' provided for within the framework of the PNIRE (Article 8(5)). The Decree-Law of 18 April 2019 sets out the methods and time frames for implementing the single platform. In this regard the Ministerial Decree which establishes the methods for implementing the single platform and the first steps towards implementing the PNIRE is being finalised. The single platform will provide the minimum information needed to better assess recharging prices charged by operators. To this end a Ministerial Decree on the comparability of prices for recharging electric vehicles is being drawn up.

In summary, Italian Legislative Decree No 257/2016 provides for an increase of:

- charging points (public and private) for electric vehicles from the current 2,900, approximately, up to at least 6,500 in 2020;
- sales points supplying CNG from the current number of around 1,100 to around 2,400 in 2030;
- sales points supplying LNG from the current number of a few dozen to around 800 in 2030.

To incentivise wider use of electric vehicles, the introduction of pricing instruments in favour of electricity is being considered, such as, for example, waiving the payment of system charges for the withdrawal of electricity for the purpose of charging vehicles.

- **Modal shift in the field of transport of persons**

The intention is to launch a program for promotion of alternative mobility which puts in place instruments for encouraging:

- development of mobility for cyclists through cycle paths;
- promotion of shared mobility (bike, car and motorbike sharing with low or zero emissions);
- integration between sustainable mobility services (for example, parking structures for bicycles or car and bike sharing services close to public transport stops) and interchange parking;
- promotion of smart working tools;
- promotion of car-pooling, including by creating public or private platforms to match demand and supply, with an assessment of the feasibility of calculating and recording the savings underlying such activities;
- development of ITS (traffic management, infomobility, smart roads).

Italy will cooperate with the EU bodies to study the review of the car ownership tax based on actual annual use of the vehicle, with mechanisms to safeguard the most vulnerable groups and obligatory use.

Through the Budget Laws for 2016 and 2017, the national system of cycle paths has been funded with national resources at a total of €372 million from 2016 to 2024.

Up to now, the resources have been allocated for the design of the seven routes in respect of which the protocol agreements have been signed. These include, for example:

- the Grande Raccordo Anulare delle Bici di Roma (GRAB) (Rome's ring road for bikes);
- The VEnTO cycle route that links Venice and Turin, passing through numerous historic

- cities, such as Mantua and Ferrara, and big cities such as Milan;
- the 'del Sole' cycle path that departs from Brennero, running from the north to the south of Italy and finishing in Sicily, in Palermo, and in Sardinia in Cagliari.
- the Apulian aqueduct and the Magna Graecia cycle routes;
- the Tyrrhenian and the Adriatic cycle routes.

The Italian government is also trialling smart road projects in Turin and Modena, the aim of which is to create road infrastructure equipped with platforms for traffic observation, monitoring and forecasting with a link between digital infrastructures and new generation vehicles.

Several measures have already been launched, such as for example the call for tender from the Ministry of Environment, Land and Sea Protection aimed at urban areas, for creating cycle paths and sharing mobility (€15 million allocated for 2018).

Within the draft budget of the Ministry of Infrastructure and Transport, the Budget Law for 2019 provided for a fund for intercity cycle routes, with an allocation of €2 million for 2019.

The Budget Law for 2020 establishes, within the same draft budget, a fund for the development of urban cycle networks, with an allocation of €50 million for each of the years 2022, 2023 and 2024. The fund covers 50% of the total cost of the work necessary to build new city cycle paths created by municipalities and groups of municipalities.

Lastly, the feasibility of extending the White Certificates system to promote shared forms of transport (car sharing and car-pooling) will be assessed.

- **SUMP: Sustainable Urban Mobility Plans**

For all metropolitan cities, bodies covering extensive areas, municipalities with more than 100,000 inhabitants and for cities with high levels of PM10 and/or nitrogen dioxide pollution (also with a population of fewer than 100,000 inhabitants), it will be mandatory to prepare a SUMP (no longer linked to mere provision of funding) by 2021, providing also that municipalities with a population of more than 50,000 inhabitants, using simplified guidelines, will have to prepare a SUMP as a mandatory requirement for access to funding by 2025.

The SUMPs make it necessary to harmonise existing measures and interventions within the framework of the replacement of the current LPT, sustainable mobility and the optimisation of the management of the movement of goods and people.

Furthermore, in their urban plans the municipalities should include an energy plan that identifies a target quota of renewable energy that can be produced on site, as well as the tools needed to reach that objective.

For car-pooling in particular, in order to maximise the potential for energy savings, the promotion of digital platforms for mapping supply and demand will be assessed. The platforms could be used to manage the service and to record savings made, with potential issuance of energy efficiency certificates that can be traded and used to buy public transport tickets.

Italy will cooperate with the EU bodies to study the review of the car ownership tax based on actual annual use of the vehicle with mechanisms to safeguard the most vulnerable groups and obligatory use.

- **Summary of measures**

Italy, as described in the preceding sections, proposes to achieve energy savings, calculated on the basis of the provisions set out in Article 7 paragraph 1 of the EED, by means of different key mechanisms, already activated or to be activated at national level.

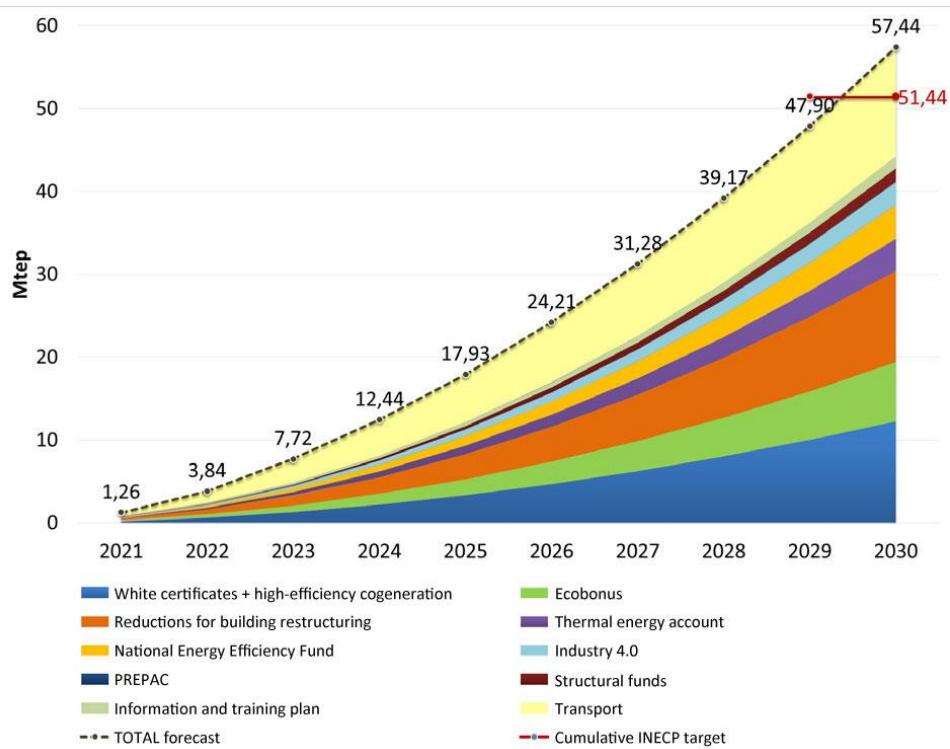
The table below shows a summary outline of the main elements of the mechanisms described.

Table 28: Summary of measures for meeting the targets set under Article 7 of the EED and the main sectors involved

Type of measure	Name of measure	Sector				Energy poverty
		Residential	Tertiary	Industry		
Obligation scheme	White certificates					
Alternative measures	Tax reductions (bonus casa + Ecobonus)					
	Conto Termico					
	National Energy Efficiency Fund					
	Industry 4.0					
	PREPAC					
	Cohesion policies					
	Information and training plan					
	Replacement of public transport fleet					
	Modal shift in goods transport					

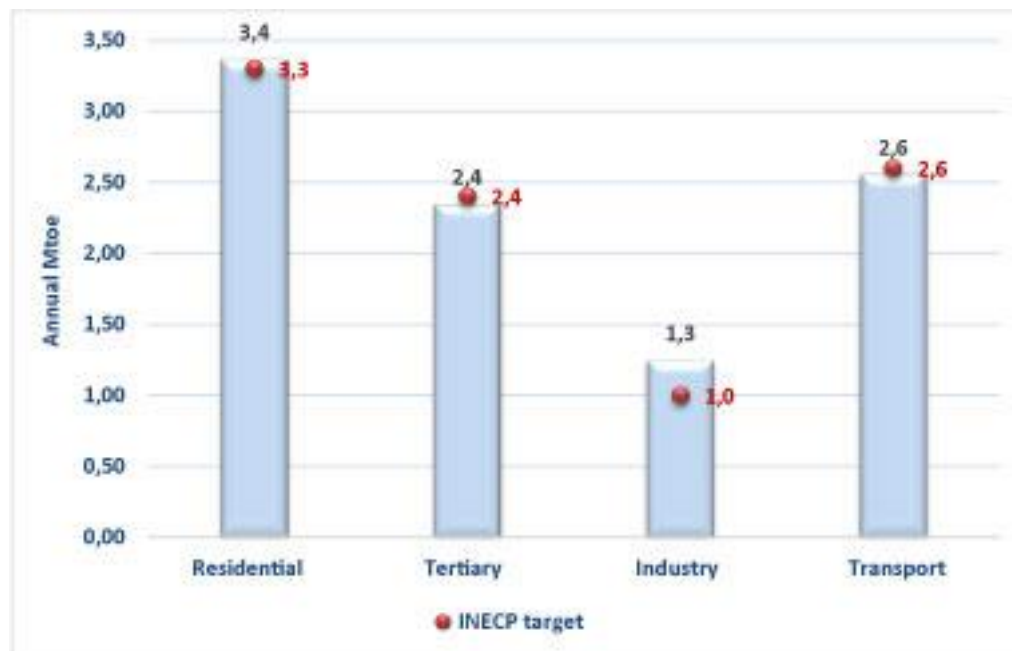
The figure below shows the cumulative savings targets for each of the mechanisms proposed. Based on a confirmed minimum end-use energy saving target of 51.4 Mtoe, compared with 50.98 Mtoe calculated on the basis of the average consumption of end-use energy for 2016-2018, initial estimates of the impact of the mechanisms proposed indicate a cumulative saving of 57.44 Mtoe. Using the annual results provided by the monitoring tools already in place for 2014-2020, it will be possible to react in good time wherever a progression in savings that is not sufficient to achieve the targets is recorded and to propose appropriate adjustments where there are gaps between targets and results.

Figure 40 – Outline of energy savings achieved (Mtoe of end-use energy)



The following histogram shows an indicative assessment of the savings on a sectoral level that are expected to be achieved in 2030 following the implementation of the measures described, in relation to the sector energy efficiency target set out in section 2.2.

Figure 41: Summary of expected savings in 2030, by sector (Mtoe of end-use energy)



ii. Long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private¹², including policies, measures and actions to stimulate cost-effective deep renovation and policies and actions to

¹² In accordance with Article 2a of Directive 2010/31/EU

target the worst performing segments of the national building stock, in accordance with Article 2a of Directive 2010/31/EU

In order to make promotion of energy efficiency in the civil sector consistent with the targets and effective in relation to the goal by periodically evaluating the progress made, a long-term strategy will be prepared for renovation of building stock that provides intermediate and final targets, in accordance with the provisions of Directive (EU) 2018/844 on energy performance in buildings. Specifically, the strategy will be published upon transposition of the aforesaid Directive, expected by 10 March 2020.

This section details the first guidelines in terms of targets for 2030 and for the subsequent decades, and some elements relating to promotional measures which will form the basis of the aforesaid strategy.

It is estimated that, due to the measures currently in force (in particular tax deductions, White Certificates and the Conto Termico, already described in section 3.2.1, and via the central government programme to upgrade the energy efficiency of buildings (PREPAC)), by 2030 it will be possible to attain an annual energy saving from building restoration of 5.7 Mtoe, of which 3.3 Mtoe comes from the residential sector and 2.4 Mtoe from the tertiary sector (public and private). Considering a technical average lifespan of twenty years for the measures, the aim is to reach in 2040 and 2050 an indicative annual savings target of 11.4 Mtoe, with 6.6 Mtoe in the housing sector and 4.8 Mtoe in the tertiary sector.

The energy savings potential in the civil sector remains broad, however, and often achievable via efficiency measures with sustainable return times. Nevertheless, numerous barriers - different in the sectors of application - and in some cases, return times that are too long - prevent these savings from being fully realised. Efforts to reach these energy saving targets are thus focused also on overcoming these barriers, streamlining and reinforcing instruments and actions dedicated to each segment and sector. Specifically, the following measures are planned:

- the reinforcement of minimum and regulatory standards;
- the introduction of measures to improve the quality of energy performance certificates (EPCs) and ways of promoting the purchase of residences in a high energy class;
- promoting the use of demand-response technology, ICT systems and home automation which permit the monitoring and control of building performance;
- improving tests for verification of compliance with regulations and standards;
- improving integration among rules for energy efficiency and renewable sources in buildings;
- evaluating the possibility of introducing energy efficiency obligations in the event of renovations, where justified in terms of the cost-benefit ratio, and introducing new limits on the use of cooling installations;
- promoting synergies with renewable sources in the form of self-consumed energy, as highlighted in the public consultation.

Particular attention will be paid to updating and integrating of promotional instruments, for which, as already described in section 3.2.1, there is a plan to implement actions to increase efficiency in terms of costs for the beneficiaries and for the national system and to encourage deep renovation. Schemes for promoting measures in buildings used by public bodies will also be improved, as these must provide an example and guidance to the entire business sector.

Fundamental factors for the success of the measures mentioned are, additionally, simplification of administrative procedures, controls and enforcement of the measures implemented, the strengthening and enhancing of the ESCo model, measures for communication and to raise awareness, improvement of the monitoring systems and recording of results, and support for research and innovation.

Assessment will be made of the potential systemisation, at national level, of all the weather and climate data held for various reasons by public and/or research bodies and by data survey and certification campaigns on an ongoing basis, with the aim of building a solid database for implementing dynamic building simulation and energy certification models.

Additionally, measures to improve the quality of energy performance certificates (EPCs) and ways of promoting the purchase of residences in a high energy class will be introduced, including for promoting the market for buildings with increased standards of energy efficiency.

An important contribution to energy efficiency, in addition to that described above, will lastly come from improving minimum efficiency standards for buildings and from the improvement of mandatory provisions in relation to integration of renewable energy sources in buildings.

The strategy will set out indicative milestones for 2030, 2040 and 2050, coordinated with the Energy and Climate Plan and with the long-term strategy for decarbonisation by 2050; in this context the Italian strategy envisages ambitious emission reduction scenarios, in line with EU guidelines.

Lastly, consideration will be given to revising the ways in which costs linked to individual heat extraction in multi-apartment buildings are distributed, in order to better encourage the adoption of energy upgrading measures for the entire building.

iii. Description of policies and measures to promote energy services in the public sector and measures to remove regulatory and non-regulatory barriers that impede the uptake of energy performance contracting and other energy efficiency service models¹³

Article 14(4) of Italian Legislative Decree 102/2014, transposing the EED, provided for the improvement of the EPC contractual model - already provided by Italian Legislative Decree 192/2005, transposing the EPBD - by means of the minimum elements that must feature in energy performance contracts agreed with the public sector, listed in Annex 8 of that same decree. The ENEA has therefore prepared a document entitled 'Guidelines for Energy Performance Contracts (EPC)' which is currently being distributed across Italy.

The proposed model is aimed at public bodies, to facilitate for the latter the signing of contracts to promote energy efficiency in buildings occupied by them; it is designed to encourage the involvement of private operators (ESCOs, credit institutions, etc.) in order to generate economies of scale, and to be clear and transparent about the results to be achieved, while complying with both contracting procedures in accordance with current legislation and with new provisions on energy efficiency in buildings.

However, several criteria and barriers to dissemination of energy performance contracts have been identified, which are expected to be overcome in the short-term. In fact, the EPC contractual model is currently an atypical kind of contract in the Italian legal framework.

¹³ In accordance with Article 18 of Directive 2012/27/EU

This atypical nature, linked to its being a multi-service contract (works, services and supplies), creates regulatory uncertainty about its legal classification which, in the absence of legislative characterisation, opens itself up to multiple interpretations which in fact do not encourage the creation of a single category of contract.

Currently, the EPC for buildings may be issued both through the procedures provided for procurements, or through the patent granting procedure (PPP), and whether in one form and the other, the legislative uncertainty is such as to limit its prevalence.

Therefore, in order to promote a more widespread use of the EPC, eliminating the current barriers, the plan is to introduce into the Italian Code of Public Contracts (Legislative Decree 50/2016 as amended and supplemented), the definition of the EPC for buildings as a special contract, and a new type of PPP contract for EPCs for buildings which sets out the specific details.

In addition to the aforesaid, considering the potential to reduce consumption by public bodies and the example that the public system should provide, the inclusion of mandatory savings clauses in energy contracts entered into by public bodies will be established.

Additionally, as regards the legal obligations relating to energy efficiency, sanction and reward systems will be set up for the managers/officials responsible for building management.

It is also considered appropriate to strengthen several key enablers, which are fundamental for boosting private investments for the purpose of reaching the energy efficiency targets:

- structuring and monitoring the process for the qualification of workers in the sector, with particular reference to ESCOs;
- simplifying the authorisation process for access to incentive schemes;
- improving control activities in relation to standards and regulations.

Lastly, debates are being held in Parliament on the draft ‘CantierAmbiente’ legislative decree which provides that all public bodies should appoint a ‘green manager’ with a view to ensuring that environmental laws are implemented correctly within that body, as well as promoting work towards improving energy efficiency.

iv. Other planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030 as well as other objectives referred to in point 2.2 (for example measures to promote the exemplary role of public buildings and energy-efficient public procurement, measures to promote energy audits and energy management systems¹⁴, consumer information and training measures¹⁵, and other measures to promote energy efficiency¹⁶)

- **Energy audits and energy management systems**

Article 8 of Italian Legislative Decree 102/2014, paragraphs 1 and 3, identifies as parties obligated to carry out a periodic energy audit, from 2015, large companies (paragraph 1) and

¹⁴ In accordance with Article 8 of Directive 2012/27/EU

¹⁵ In accordance with Articles 12 and 17 of Directive 2012/27/EU

¹⁶ In accordance with Article 19 of Directive 2012/27/EU

companies with high energy consumption, so-called ‘energivores’ (energy guzzlers) (paragraph 3).

To date, 15,460 audits relating to 8,686 companies have been submitted to the ENEA. This number is destined to increase following the actions from the Ministry of Economic Development in terms of verification, monitoring and forwarding into the same database the audits of the SMEs that participate in regional tenders. The table below shows the breakdown by sector: around 45% of the audits have been carried out in the manufacturing sector and a further 10% in trade, which includes consumption by the large-scale retailers.

Table 29 - Energy audits carried out within the meaning of Article 8 of Italian Legislative Decree 102/2014 [Source; ENEA].

ATECO sector	Number of companies	Sites subject to audit	Projects with a payback time of fewer than three years	Savings potential (ktoe)	Necessary investments (million EUR)
A - Agriculture, forestry and fishing	61	108	59	2.5	2.2
B - Mining and quarrying	40	75	31	5.7	3.5
C - Manufacturing	5,131	7,032	5,271	595.3	491.4
D - Electricity, gas, steam and air conditioning supply	232	492	194	38.1	32.2
E - Water supply, sewerage, waste management and remediation activities	324	921	276	24.3	18.7
F - Construction	175	323	97	10.1	6.9
'G' - Wholesale and retail trade, repair of motor vehicles and motorcycles	892	2,433	896	24.2	21.2
H - Transport and build-up	416	934	272	27.7	18.1
I - Accommodation and catering operations	110	309	112	2.6	3.1
J - Information and communication	160	664	255	19.6	20.6
K - Financial and Insurance Activities	244	597	151	2.4	2.3
L - Real Estate Activities	59	114	52	2.2	2.2
M - Professional, scientific and technical activities	255	316	66	1.4	1.0
N - Administrative and support activities	250	449	62	1.0	0.8
Other	337	693	570	22.5	22
Total	8,686	15,460	8,364	779.6	646

From analysis of the audits received, the energy savings potential resulting from projects with an investment payback time of 3 years is significant: with around 8 400 projects, an energy saving of around 0.78 Mtoe/year is possible, compared with around €650 million of investment.

The following table thus shows the potential of investments and savings, according to the different periods of economic payback.

Table 30 - Interventions, investments (€) and savings (toe) of energy efficiency measures identified in the energy audits carried out within the meaning of Article 8 of Italian Legislative Decree 102/2014 for the payback time of the investment; cumulative values [Source: ENEA].

Payback time (years)	Interventions	Investments (€)	Savings (toe)	Savings potential (Mtoe)
≤ 3	8,364	646,335,323	779,560	0.4
≤ 5	14,193	1,631,881,852	1,168,814	0.8
≤ 10	21,923	2,657,662,287	1,414,719	1.1
≤ 20	25,698	3,341,674,298	1,501,881	1.2
≤ 30	26,284	3,449,551,432	1,509,606	1.2

The high number of audits carried out will continue to grow thanks to the Ministry of Economic Development's initiative for cofinancing on a regional level of energy audits in SMEs or the adoption of energy management systems which conform to the ISO 50001 standards. The Regions, in turn, have made available up to a further €15 million annually for public cofinancing which in total covers 50% of the costs of carrying out the energy audit.

In the period 2021-2030, the plan is to carry out the energy audit preparation programme in large companies and in energy-intensive companies, extending it also to energy-intensive companies in the gas sector and correlating the benefit perceived by the energy-intensive companies with carrying out energy efficiency measures as part of their own production process, as also emerged from the public consultation. It is however considered important to update provisions in order to increase the effectiveness of the instrument, focusing the audit on companies and on sites with the greatest energy savings potential.

It will also be expedient to complement this instrument with a scheme to promote energy management systems which conform to ISO 50001 standards, in order to realise savings identified in the audits themselves.

Activities to promote energy efficiency in SMEs will also be carried out, renewing the cofinancing initiatives for energy audits and energy management systems, for example creating links with support instruments present at a national and local level, supporting energy efficiency training programmes in conjunction with the relevant traders' associations, and laying the groundwork for promotion of voluntary agreements between companies which have as their target the promotion of energy efficiency.

Lastly, in order to increase awareness among companies in terms of their own energy consumption and to improve awareness in relation to implementing measures to reduce need, the provisions relating to rational use and energy conservation will be updated, evaluating in particular the energy balance of the company. This instrument will make it possible to increase energy awareness among management in the business sector, making policy making activities more effective.

- **Mandatory integration of renewables in new or renovated buildings**

The subject, which intersects with the issues of efficiency and renewable sources, is discussed in the sections of this chapter dedicated to renewable energy and heat sources.

- **Heating and cooling**

In the heating and cooling sector, provisions relating to air conditioning installations will be updated, with the specific intention of gradually replacing installations with high emissions (including diesel boilers and non-efficient biomass installations) with low-emission, highly efficient technology.

The measures will therefore be reinforced to ensure compliance with regulations and standards, increasing monitoring activity of the hours of operation for heating installations in order to verify that there are no anomalies in respect of the limits of use.

The introduction of new limits on the use of cooling installations will then be assessed, through the establishing of constraints (e.g. days of use, hours, minimum temperature) to be imposed in relation to the relevant climate zone.

In this regard, the development of district heating and district cooling will also be encouraged, in order to exploit the residual economic potential highlighted in chapter 2. To this end, instruments will be put in place to update the facilitation framework in the sector. For example, this has already been provided by an implementing provision of Italian Law 172/2017, which establishes subsidies for cogeneration installations which lead to increased heat production capacity aimed at maintaining or reaching an efficient district heating system set-up within the meaning of Italian Legislative Decree No 102 of 4 July 2014, and which is combined with an extension of the network in terms of increasing transport capacity.

Lastly it will be fundamental to increase awareness and the active role of consumers, using, for example, home automation, network digitalisation and smart metering, the promotion of which will be assessed using appropriate tools. The implementation of the provisions already provided for by Italian Legislative Decree No 102/2014, in relation to systems for metering and billing of energy consumption in the housing sector, will be completed and if necessary improved, in order to provide accurate and timely information to the consumer about their own energy consumption, a necessary condition for promoting correct, or in any case more efficient, behaviour. To this end, the best use will be made of increasing digital connectivity (ultra-wideband technology) and the development of applications for remote control of buildings, also encouraging a different role for electricity and gas sellers, who will be able to develop commercial proposals aimed not solely at the sale of the commodity, but also at the offer of services to manage consumption.

Public lighting

As regards public bodies, the intention is to build an energy efficiency programme, starting first with public lighting. In this sector, the programme will provide a set of measures, targeted at local public bodies, aimed at accelerating the ongoing process for replacement of light sources and the installation of consumption monitoring systems, alongside more efficient reprogramming of hours of use.

In this connection, the Budget Law for 2018 established that public bodies are obliged to redevelop public lighting systems by 31 December 2023, guaranteeing a reduction in electricity consumption of at least 50% in relation to the average consumption 2015-2016. The companies, involved in development of measures, may take advantage of the subsidies supplied from the revolving Fund for supporting companies and investment in research, where €300 million have been allocated for the granting of subsidised loans.

- **Cooperation between central government and local authorities in terms of energy efficiency**

A specific model of governance will be adopted, without prejudice to the central role of the State, which promotes active contribution by all central government authorities, the Regions and the municipalities, to reaching the national energy efficiency targets, through:

- the continuous improvement of energy efficiency instruments implemented nationally and locally, reorganising, for example, energy efficiency measures in order to allow for better coordination and to avoid measures overlapping or clashing (the POR FESR, FNEE, Conto Termico);
- the monitoring, enhancing and support of initiatives provided on a central and local level and the results obtained.

A particularly useful instrument in this sense was the aforementioned burden sharing of the renewables target, expressed as a proportion of consumption, so as to also encourage regional and local energy efficiency incentives. The new Monitoring Body will occupy itself more explicitly with energy efficiency.

- **Energy efficiency measures under the Budget Law for 2020 and the Decree-Law on Tax for 2020**

The Budget Law for 2020 assigns to the municipalities contributions of up to €500 million per year, for investment in public works for increasing energy efficiency, including public lighting, energy saving in publicly owned buildings and public housing, and the installation of energy plants fuelled by renewable sources. The subsidies can also be used by the municipalities for projects in the areas of sustainable local development, sustainable mobility, upgrading and safety assurance in schools, public buildings and municipal property, and removing architectural barriers. Decree-Law No 124 of 2019, converted into Law No 157 of 19 December 2019 (the Decree-Law on Tax for 2020), establishes a fund with an allocation of €2 million for each year from 2020 to 2029, with spending authorisation and relative financial cover also provided for 2030, for the energy restructuring and upgrading of former psychiatric hospital buildings.

The Budget Law for 2020 establishes in the statement of estimates of the Ministry of the Interior a fund for investment by municipalities with an allocation of €400 million for each year from 2025 to 2034. The fund will be used to boost investments in sustainable infrastructure development and improve energy efficiency in Italy. The focus will be on public building expenditure (including maintenance and safety and energy efficiency), maintenance of the road network, hydrogeological instability, prevention of seismic risk and promotion of cultural and environmental heritage.

In addition, a change has been introduced to the provisions of Law No 145 of 30 December 2018 (the Budget Law for 2019) which assigns the municipalities allocations of:

- €350 million for 2021;
- €450 million for 2022;
- €550 million for each year from 2023 to 2025;
- €700 million for 2026;
- €750 million for each year from 2027 to 2031;
- €800 million for each of the years 2032 and 2033;

- €300 million for 2034.

This funding can be used for improving safety and energy efficiency in the buildings owned by the municipality, with precedence given to school buildings. Through a change to the Budget Law for 2019, for 2021-2034 the non-autonomous Regions have been assigned allocations for investments in public works for safety and energy efficiency improvements on buildings and land. The funding is also intended for road improvements, safety improvements and the development of public transport systems to reduce environmental pollution, for urban regeneration and conversion to renewable energy sources, for social infrastructure and for environmental reclamation of polluted sites. These allocations amount to:

- €135 million for each of the years 2021 and 2022;
- €335 million for each year from 2023 to 2025;
- €470 million for 2026;
- €515 million for each of the years from 2027 to 2032;
- €560 million for 2033;
- €200 million for 2034.

To facilitate these investments, the Budget Law for 2020 assigns the local authorities allocations, subject to cost reporting, to cover the definitive planning and execution of measures to ensure the safety of areas at hydrogeological risk, to improve safety and energy efficiency in schools, public buildings and municipal heritage and to ensure the safety of roads of up to €85 million for 2020, €128 million for 2021, €170 million for 2022 and €200 million for each of the years from 2023 to 2034. Furthermore, to finance public works in the areas of road safety assurance and extraordinary maintenance and energy efficiency of schools in the provinces and cities, expenditure of €100 million for each of the years 2020 and 2021 and of €250 million for each of the years from 2022 to 2034 is authorised.

In addition, it has been established that the Ministry of Education, Universities and Research draw up a national plan of measures to improve energy efficiency in publicly owned school buildings which already meet all the necessary structural safety requirements, identified on the basis of criteria which take into account energy consumption, estimates of energy savings and management cost reduction for the local authorities that own or manage them, as well as the existing student population and the size of the buildings. The resources allocated total €40 million, that is, €20 million a year for 2022 and 2023; implementation is supported by the European Investment Bank, also via the creation of the Energy Service Company (ESCo)

Decree-Law No 124 of 2019, converted into Law No 157 of 19 December 2019 (Law on Tax for 2020), changes the way the resources that the taxpayer devolves to the State under the 'eight per thousand' regime for IRPEF (personal income tax withholdings) are allocated, with reference in particular to the share directed towards the restructuring, improvement, safety assurance, earthquake-proofing and energy efficiency improvement of publicly owned school buildings. To guarantee a fairer distribution of such special measures throughout the country, starting from the 2019 tax declaration the resources will be allocated in three equal parts to the geographical areas of the North (Piemonte, Valle d'Aosta, Lombardy, Liguria, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia and Emilia-Romagna), Central Italy and the Islands ((Tuscany, Umbria, The Marche, Lazio, Sicily and Sardinia), and the South (Abruzzo, Molise, Campania, Puglia, Basilicata and Calabria).

Lastly, the Decree-Law on Tax for 2020 provides for measures to broaden the use of resources assigned to the Regions for local interventions and for the safety of the national rail network. More specifically, the scope of the investments planned for 2021-2033 for the non-autonomous Regions has been widened to include the transport sector and modernisation with a view to reducing environmental pollution and encouraging investment in urban regeneration, conversion to renewable energy sources, social infrastructure and environmental restoration.

v. Where applicable, a description of policies and measures to promote the role of local renewable energy communities in contributing to the implementation of policies and measures in points i, ii, iii and iv

See question 3.2.1.v

vi. Description of measures to develop measures to utilise energy efficiency potentials of gas and electricity infrastructure¹⁷

The infrastructure pricing regulation will include the energy efficiency parameter for the purposes of compensating operators.

vii. Regional cooperation in this area, where applicable

This will mainly be based on the exchange of best practices with the countries with which Italy has activated the regional cooperation process, focussing on the policies Italy has adopted that have attracted the interest of other countries.

viii. Financing measures, including Union support and the use of Union funds, in the area at national level

In the shared planning of the structural funds intended for Italy for the period 2021-2027, with particular reference to the European Regional Development Fund (ERDF) and the Cohesion Fund currently under discussion, and for the successive period 2028-2034, priority will be given to implementing the INECP, including to facilitate the building of the 2014-2020 partnership agreement.

In line with the other objectives in the planning cycle, particular attention will be paid to the allocation of significant resources at a local and national level for initiatives aimed at decarbonisation of the public and private building stock and at measures for limiting mobility requirement and increase in collective mobility, in particular via rail, in particular the switching of the transport of goods from road to rail. It is in fact recalled that the five EU investment priorities include those aimed at creating a greener Europe free of carbon emissions.

Decree-Law No 34 of 30 April 2019 (the Growth Decree-Law) establishes a contribution for the municipalities of up to a maximum of €500 million in 2019 to be drawn from the Development and Cohesion Fund for interventions relating to investment in the field of energy efficiency and sustainable local development. The contribution is assigned to each municipality on the basis of the resident population on 1 January 2018, as follows:

a) €50,000 to municipalities with a population below or equal to 5,000;

¹⁷ In accordance with Article 15, paragraph 2, of Directive 2012/27/EU

- b) €70,000 to municipalities with a population of between 5,001 and 10,000;
- c) €90,000 to municipalities with a population of between 10,001 and 20,000;
- d) €130,000 to municipalities with a population of between 20,001 and 50,000;
- e) €170,000 to municipalities with a population of between 50,001 and 100,000;
- f) €210,000 to municipalities with a population of between 100,001 and 250,000;
- g) €250,000 to municipalities with a population of over 250,000.

The contributions are to be used for public works in the areas of:

c) energy efficiency, including interventions for public lighting, energy saving in publicly owned buildings and public housing, as well as installation of plants for renewable energy production;

d) sustainable local development, including interventions in the areas of sustainable mobility, updating and safety assurance in schools, public buildings and municipal heritage and for removing architectural barriers.

From 2020, for the projects mentioned above, the Growth Decree-Law authorises the implementation of a multi-year financing programme, the resources of which are divided between municipalities with a population of below 1,000, assigning each one an equal amount.

In the Director's Decrees of 14 May and 10 July 2019, the Ministry of Economic Development set out the size of contribution to each Italian municipality and the methods for implementing the measure (eligible interventions, the contribution that can be granted and the methods for granting it, monitoring of the measure).

As for the national financing measures, please refer to the description of the individual measures.

3.3 Dimension energy security¹⁸

i. Policies and measures related to the elements set out in point 2.3¹⁹

The main interventions put in place to ensure that the security levels of the electricity, gas and petroleum products systems are sufficiently high and maintained can be attributed to the measures described below.

Gas sector

- **Revision of the Preventive Action Plan for the Italian natural gas system, in accordance with the new Security Regulation (Regulation (EU) 2017/1938)**

Update of Annex I to the Ministerial Decree of 18 October 2017. The Preventive Action Plan contains the results of the assessment carried out on the risks that could affect the security of the national natural gas system, setting out crisis scenarios and impacts, and also the measures that can be put in place to maximise supply and contain demand, in order to sufficiently offset any supply disruptions in good time, guaranteeing in any case that protected customers (household customers and public services) are supplied, and the preventive measures for managing and containing the risks. In the 2017 Plan, the capacity of the system to satisfy total gas demand, including in the event of the key infrastructure for supplying gas breaking down, was verified by applying the 'N-1' formula defined in the European Regulation. The verification for 2017 delivered a positive result, but the situation has since changed owing to the unavailability of one of the two gas pipelines making up the TENP pipeline system in Germany, which connects the Transitgas gas pipeline in Switzerland to northern Europe. This is all taken into account in the 2019 update to the Preventive Action Plan, currently being consulted by the other Member States, and which provides, among other things, for greater cooperation between Member States, in the light of changes that have taken place concerning national supply infrastructure.

- **Update of the Emergency Plan for the Italian natural gas system, in coordination with the Emergency Plans of the other Countries connected to the same supply corridors covered by Regulation (EU) 1938/2017**

Update of Annex II to the Ministerial Decree of 18 October 2017. The Emergency Plan sets out the conditions for activating the three different crisis levels that may arise as a result of unfavourable conditions, defines the types of measures for dealing with crisis situations and the procedures for implementing them, and identifies the companies and operators in the gas and electricity sector that are responsible for implementing those measures.

- **Adapting the functions of the gas transport and storage network**

In view of the scenarios covered by this Plan and the objectives to be achieved as mentioned above, the national natural gas system is expected to play only a minor role in terms of overall use, but will need to be more resilient and flexible as regards absolute performance, in order

¹⁸ Policies and measures shall reflect the energy efficiency first principle

¹⁹ Consistency shall be ensured with the preventive action and emergency plans under Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010 (OJ L 280, 28.10.2017, p. 1) as well as the risk preparedness plans under Regulation (EU) 2018/2001 [as proposed by COM(2016) 862 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC].

to successfully confront not only unfavourable events that could lead to problems in the Italian gas system, but also sudden weather changes that could adversely affect the production of energy from RES.

The national natural gas system has always been flexible enough to cover peaks in heating demand during the winter and variations in thermoelectric demand during the summer. According to the analysis of the data relating to gas consumption associated with the scenario detailed in this plan, in order to keep the transport, LNG and gas storage infrastructure at its current levels of availability and efficiency, the gas system will need to continue providing such flexibility, meeting daily peaks and guaranteeing seasonal coverage.

However, the analysis cannot disregard more in-depth adequacy assessments based on time and location, incorporating a dynamic analysis of the relative gas flows: indeed, the actual gas consumption for the local thermoelectric sector will depend on the volatility of the demand for residual heat, which is determined by:

- the actual production from plants and any unplanned intermittences (absence of wind or excessive wind, momentary cloud cover, especially dry periods);
- the location of renewable energy generation plants;
- the spread and location of storage systems.

These factors must also be taken into account when deciding on where to locate new, high-efficiency open-cycle gas-fired thermoelectric power plants in order to balance the network (peaking power plants), when they need to be constructed following the closure of coal-fired power plants.

- **Diversification of supply sources, including via LNG**

Given the increased uncertainty and the possible critical issues – which have all occurred in the past but never all at the same time – arising from disruptions to gas pipeline supplies, Italy is actively pursuing a strategy for diversifying and increasing LNG supplies (which currently cover around 9% of national gas requirements), with the aim of also supporting the measure of gradually introducing a limit of 0.1% of sulphur content in fuels used by ships at berth in ports and passenger vessels (Sulphur Emission Control Areas) and guaranteeing the presence of more spot supply sources able to compete for the position of marginal source, keeping in line with European prices.

- **Increasing the use of LNG by maritime transport vessels and port infrastructure**

The following measures aim to increase the use of LNG by maritime transport vessels and port infrastructure, with benefits not only in terms of the environment, but also the economy and industry:

- making the construction of LNG storage and/or distribution facilities in ports exempt from tax;
- establishing appropriate port tariffs that encourage the use of LNG-powered vessels;
- agreeing forms of funding with the EU in order to build LNG storage facilities and LNG-powered vessels, in line with EU policies;
- introducing incentive measures for shipbuilders to construct LNG-powered vessels;
- removing barriers, including related to authorisations, to the installation of infrastructure for the supply of LNG to the road network and within ports;
- facilitating the supply phase by promoting the construction of small-scale coastal

storage facilities. To create such storage facilities, the support of the port authorities and guaranteed authorisation procedures with clear timeframes are key;

- promoting the creation of micro liquefaction units connected to the gas network.

Petroleum products

The transition to energy production based less and less on fossil fuels will take time and require the national downstream petroleum industry to be kept at the cutting-edge (from both an environmental and a technological perspective), efficient and competitive, thereby guaranteeing the reliability, sustainability and security of the necessary supplies.

The actions planned up to 2030 are as follows:

- supporting, over the next few years, further interventions to convert Italy's marginal refineries to biorefineries, in line with the increase in national demand for advanced biofuels;
- focusing on plants for producing the raw materials needed for preparing biofuels for the biorefineries (the so-called 'advanced loads' made, for example, from algal oils and waste oils), so as to create a national production chain to support the transition to advanced biofuels;
- advocating reuse of industrial sites by converting them into storage facilities or other productive investments, also in order to safeguard employment levels;
- avoiding the unnecessary displacement of personnel currently occupied in the traditional sector of extracting and processing fossil and hydrocarbon products; it is necessary to form a generational pact between those who have been working within the confines of the traditional energy system and those who are looking ahead to the 2030 horizon from a very different working environment;
- boosting investments for increasing the conversion of heavy products produced by refineries and reducing the production of fuel oil, in light of the new IMO regulations;
- protecting the Italian residue refining industry, in order to allow the market to have access to products that are compatible with the environment, produced by following the highest environmental standards.

Electricity sector

- **Update of the Emergency Plan for the Security of the Electricity System (EPSES)**

The objective of the Emergency Plan for the Security of the Electricity System is to carry out the rotational disconnection of loads in order to tackle any substantial and prolonged energy shortages and to prevent uncontrolled interruptions of electricity supply, which would cause major social and economic unrest for the entire community. Annex A.20 to Terna's Network Code sets out provisions for preparing and implementing Rotational Disconnection Plans to be carried out by Distributors, in accordance with the resolution passed by the Interministerial Committee for Economic Planning (IMCEP) in 1979. Every year, the Distributors send Terna, by no later than 31 May, their respective Disconnection Plans, in which the Groups to be disconnected, the various Disconnection Periods (none of which may exceed 90 minutes) and the various combinations according to Level of Severity are identified. The Plan involves all forms of consumption apart from those which may be interrupted (which are subject to other defence plans) and those afforded privileged status, as identified in the IMCEP Resolution (hospital facilities, railway stations and airports). The measures set out in the EPSES will form part of future Risk Preparation Plans, which will need

to be drawn up in accordance with the provisions laid out in Regulation (EU) 2019/941 on risk-preparedness in the electricity sector in order to increase cross-border coordination of the security and emergency management measures.

- **Resilience**

Extreme weather events are becoming increasingly common, due in part to climate change, and can pose major difficulties to the electricity sector and other essential services, in some cases at the same time, in vast areas covering several Regions. Floods have recently devastated Regions in northern Italy (Veneto, Friuli, Liguria), central Italy (Lazio) and southern Italy (Sicily), leading them all to declare a state of emergency. In order to restore the supply of electricity, specialist personnel need to identify and repair the damage suffered by the networks, which requires them to work in adverse weather conditions and in areas that are not readily accessible, thus placing their safety at risk.

Electricity infrastructure is overly exposed to such events, and as a result, procedures have been established to identify all interventions capable of making the electricity system more resilient to those phenomena, by means of a technical panel coordinated by ARERA and the Abruzzo Committee set up by the Ministry of Economic Development following the most recent severe disruptions to the supply of electricity in central Italy, which were caused by snowfall.

In the medium to long term, on the one hand, action needs to be taken to increase the number of interventions carried out on infrastructure by meshing and reinforcing the network, and also diversify the technologies used. In that sense, for example, the use of underground power lines must be closely examined, since they are more resistant to adverse weather events (see the 2018 Development Plan), although it would take longer to repair any damages they might sustain. Terna has recently introduced a guideline for promoting the increased use of underground power lines.

In the short term, meanwhile, mitigation measures need to be put in place, for instance by installing anti-rotation devices to prevent the ice load sag effect, and using remote control.

The ‘resilience’ of the system also encompasses all the activities that network operators have to carry out in order to reduce the time taken to restore supply, which need to be coordinated with the main entities involved (local bodies, the Civil Protection Department, road operators, etc.) and require the available resources to be provided.

Both the operator of the national transmission network and the distributors are required to submit resilience plans that identify the areas and lines at risk and the interventions to be carried out as a priority in order to make the network infrastructure more resilient.

- **Defence Plans for the transmission network and adoption of measures for constant technological adaptation**

The Defence Plans will need to take sufficient account of the decommissioning of Italy’s coal-fired thermal power plants and the gradual increase in energy production from renewable sources. In-depth analysis and studies of the network will need to be carried out in order to assess what possible countermeasures could be taken in the event of the network deteriorating or in cases of distributed generation (low load).

- **Capacity market**

The measure, (Ministerial Decree of 28 June 2019) initially approved by the EC in 2018 and then in 2019 in its revised version with new emissions limits for participating plants, provides for annual auctions to be introduced by Terna, open to all technologies capable of contributing to the adaptation objective, in order to supply resources, including those from outside Italy, to cover the requirement expressed by Terna, which is based on a long-term assessment that is updated every year. At the first auction, held on 6 November 2019 for delivery year 2022, the TSO assigned over 40 GW of capacity broken down as follows: 34.7 GW existing capacity (of which 1 GW from RES), 1.7 GW of new power plants and 4.4 GW of virtual capacity from abroad. At the second auction, held on 28 November 2019 for delivery year 2023, the TSO assigned around 43.4 GW of capacity with an increase largely due to new plants of 4 GW, whereas overall existing capacity (35 GW of which 1.3 GW from RES) as well as virtual capacity from abroad (4.4 GW) were confirmed. In both rounds the annual premiums for capacity assigned were 33,000 €/MW for existing plants, 75,000 €/MW for new plants and around 4,000 €/MW for virtual capacity from abroad, for a total of €1.3 billion in the first allocation and almost €1.5 billion in the second. The measure is crucial for encouraging long-term, efficient, flexible and less-polluting investments, with a view to rendering the sector carbon-free and achieving the ambitious targets for phasing in renewable sources between now and 2030.

- **Adapting the rules governing the permits granted to thermoelectric power plants**

Updating the rules governing the permits granted to thermoelectric power plants, streamlining the procedure in the event of minor modifications being made to existing plants in order to make the system more flexible, as well as governing any possible stages (maximum time frames and methods) of temporary maintenance, incorporating the current stages of permanently shutting down and decommissioning the plant.

- **Cyber-security**

Adapting the national cyber-security measures (identification of risks and actions to combat them) with respect to the changes made to the regulations governing that field, resulting both from the implementation of the NIS Directive, and from the planned adoption by the European Commission of a suitable network code for that field. These national measures, together with those coordinated with the other EU Member States, will form part of the Risk Preparation Plan provided for in Regulation 2019/941.

ii. Regional cooperation in this area

- **Cross-border coordination**

Working alongside the other EU Member States to define new models for cross-border coordination amongst the TSOs concerning information and initiatives for preventing risks and managing any possible critical issues and emergencies affecting the system. In this respect, the new responsibilities will include drawing up and regularly updating the Risk Preparation Plan, starting from identifying the risk scenarios from both a national and regional perspective, defined according to the methods provided for in the EU legislation in the course of being adopted, and also with reference to the adoption of solidarity and reciprocal support measures between States and coordination in the field of cyber-security

- **Defining the solidarity measure with other Member States, and structuring them**

Coordination with the TSOs, Ministries and Regulators of the other Member States having a direct interest in the three main corridors for supplying gas to Italy, in order to enter into bilateral agreements that set out emergency measures, their quantifications and the associated economic aspects.

- **Coordination of the ten-year plans for developing the Italian nation gas pipeline network with the plans of the other European TSOs, and studies into the possible use of the gas infrastructure to also transport hydrogen-containing mixtures**

In view of the gradual ageing, both in Italy and in Europe, of the natural gas transport infrastructure making up a network that was first constructed over 40 years ago, and also the possible need to adapt that network owing to the introduction of new interconnections or new supply routes that have already been defined, the development plans for the network itself need to be constantly updated in order to ensure continuous supply to the end customers, by replacing the oldest sections and optimising the transport networks by also inputting natural gas/hydrogen mixtures and biomethane. In order to encourage greater use of biomethane, plans have been made to set up a single department for issuing permits, simplify the connection procedures, introduce regulatory measures, and also possibly impose an obligatory percentage quota of renewable gas (including hydrogen from renewable sources) to be input into the networks, this quota being dependent on the actual availability of sustainable biomass, which can be quantified as several billion cubic metres. The intention is also to foster the use of biomethane for all non-electrifiable sectors.

- **Cross-border cyber-security**

The issue of cyber-security forms part of the move for increased cross-border cooperation. Following a G7 meeting that took place in Rome in 2014 and focused specifically on energy security, Italy will continue to campaign for the establishment and development of a conducive environment for allowing the competent system operators and agencies to look into effective procedures for implementing the cooperation and monitoring the progress made. This cooperation, which will also involve universities, research institutes and companies from the private sector, will mainly consist of a comparison of the existing national architectures, joint initiatives, prevention and response systems, and research into and monitoring of technology supply chains. With specific reference to the G7, Italy has continued the work that began in 2014 in Rome at the G7 meeting on energy security, by continuing the debate on the threats and cyber-security strategies relevant to the electricity sector and to other energy sectors.

Italy is also committed to developing other international cooperation initiatives at a multilateral level, within the framework of the International Energy Agency through the ISGAN Implementing Agreement, and the new Mission Innovation, Challenge #1 Smart Grids initiative.

iii. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

3.4 Dimension internal energy market²⁰

3.4.1 Electricity infrastructure

i. Policies and measures to achieve the targeted level of interconnectivity as set out in Article 4(d)

- **Electrical interconnections with other countries**

A first set of new infrastructure has been identified (Annex III to the NES), which is to be produced in line with TERNA's development plan and also involves interconnections with other countries, especially with:

- those lying on Italy's northern border (France, Switzerland, Austria and Slovenia);
- the border with South-East Europe, where there is a diversified and competitive production capacity that will increase in the medium to long term, which provides an alternative to gas and petroleum, owing to the mineral and water resources that are present in the countries in South-East Europe and to the potential synergies with the electricity systems in that region.

The development of the interconnection capacity with northern Africa may also provide an additional instrument for maximising the use of the energy resources. In addition, interconnectors and a new transport capacity funded by private entities (typically, large energy consumers) will be authorised and promoted.

There is still an interest in looking into further interconnection projects, provided that they are technically and financially feasible. Indeed, as was found by the Expert Group and agreed upon by the Commission, in order for a new interconnector to be constructed, it is an absolute prerequisite that its socio-economic and environmental costs and benefits are analysed beforehand, to ensure that the benefits outweigh the costs.

ii. Regional cooperation in this area²¹

In discussions with other countries with which the reinforcement of interconnections or new interconnections are planned (Slovenia, Austria, Croatia and Malta) there has been common ground with regard to these initiatives and the opportunities that the infrastructures create in terms of the stability of the electricity system. Malta in particular would look favourable on another reinforcement of the interconnection with Sicily in the next few years.

iii. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

The development of the interconnection capacity with northern Africa is important from a strategic perspective, and in that context, the power line connecting Italy with Tunisia (under the ELMED project) may provide an additional instrument for maximising the use of both countries' energy resources, and also have positive medium-to long-term effects for other Member States, which is why it is included in the list of Projects of Common Interest (PCIs). However, in order to be economically viable, the project needs a significant financial

²⁰ Policies and measures shall reflect the energy efficiency first principle.

²¹ Other than the PCI Regional Groups established under Regulation (EU) No 347/2013.

contribution from the EU, most of which originating from the Connecting Europe Facility (CEF), which will be dispensed over several years.

3.4.2 Energy transmission infrastructure

i. Policies and measures related to the elements set out in point 2.4.2, including, where applicable, specific measures to enable the delivery of Projects of Common Interest (PCIs) and other key infrastructure projects

The measures for promoting the reinforcement and improvement of the electricity transmission network, to be put in place in line with TERNA's ten-year development plan, are based on the following actions:

- **Internal network developments**

Further network reinforcements between the North-Central and Central-South zones, aimed at reducing the number of hours of congestion between those sections. The new interventions include the so-called 'Dorsale Adriatica' ('Adriatic Spine'), which consists of a HVDC power line running between the Central-South and North-Central market sections, which is connected to the electricity hubs of Villanova (or Villavalle) and Fano (or Porto Tolle).

The decarbonisation objective is posing a number of problems as regards managing the security of the Sardinian network. A new connection with Sardinia (the southern part) is being looked into. The network operator has proposed two new connections, namely 'Mainland-Sicily' and 'Sicily-Sardinia'.

These measures will also require further investment to be made on the distribution networks, which are becoming increasingly affected by the rolling-out of small and medium-sized plants.

- **Planning for the development of the national transmission network**

As part of the planning for the development of the national transmission network, provision has been made for the following: measures to speed up the approval of Development Plans; extending the scope of the cost-benefit analysis method so that it also takes environmental impacts into account; coordinating with the planning of the DSOs. The defence plans, on the other hand, will need to take sufficient account of the decommissioning of Italy's coal-fired thermo-electric power plants and the gradual increase in energy production from renewable sources. In-depth analysis and studies of the network will need to be carried out in order to assess what possible countermeasures could be taken in the event of the network deteriorating or in cases of distributed generation (low load). The defence plans must be incorporated by the resilience section of the network.

- **Developing storage systems that are instrumental in managing the security and efficiency of the national transmission network**

The development of renewables expected by 2030 has already led the TSO to quantify the requirements of new storage systems that will be needed (listed in section 2.3 iv), together with the development of the networks, in order to ensure that management is maintained under secure conditions. An assessment of the existing capacities in the different parts of the country and the best locations for storage plants is under way, taking into account the residual potential of existing water reservoirs. In addition, in line with the EU Directive that

is in the course of being adopted, the current rules governing storage infrastructure will be amended and a new regulatory framework will be defined, which will be able to foster the development and coming into operation of the new storage capacity needed according to a market model in which stakeholders compete to offer network services that are different from today's (direct management by the TSO of network infrastructure, with tariffs adjusted accordingly). To ensure that the storage needs of the system are met, in case of market collapse, provision has also been made for the TSO to be able, subject to authorisation from the ARERA, and based on the guidelines issued by the Ministry of Economic Development, to construct and operate storage systems directly connected to the national transmission network, but only in the following two cases:

- storage facilities incorporated into the national transmission network and instrumental for the security of the electricity system, but which cannot operate on the wholesale markets competing with the operators;
- storage facilities capable of providing ancillary services and which, to that end, participate in the service markets, but for which competitive tendering procedures have been launched in order to acquire those resources from market operators.

- **Prototype approach that facilitates innovative projects on energy networks**

Definition of a regulatory framework that facilitates innovative projects, including by means of a dedicated fund, allowing operators to conduct tests on site and at prototype stage, if necessary granting temporary waivers from the regulations in force, while at the same time providing for adequate mechanisms for effective cost recognition. Network operators will be particularly involved, activating a new approach of system innovation that involves commercial parties in the development of new business models downstream in the chain and in trialling multiservice offers at urban and local level. An example of this is provided by the pilot projects launched by ARERA to foster the participation of distributed resources in the dispatching services market.

- **Guidelines for recognising infrastructure costs on the basis of the service provided to users**

Progressive and gradual departure from the current approach to cost recognition, which differentiates between operational costs and capital costs, to foster an integrated approach that empowers operators. More specifically, the new integrated approach focuses on the following aspects: development forecasts and plans that are realistic, based on the future and actual needs of service customers; incentives to improve performance in terms of efficiency, cost-effectiveness and quality of service; and removal of any regulatory barriers to the development of innovative solutions. In regulating the network infrastructure the intention is to launch a programme by which new cost recognition methods are gradually consolidated, eliminating the distortions that currently arise from the differentiated regulatory treatment of operational costs and capital costs, and enhancing the service rendered to different network 'users' in terms of meaningful and measurable outputs. It will be equally important to provide the tools and flexibility necessary to support, at the lowest cost possible, the technological development and updating of the infrastructure needed to reach Italy's EU decarbonisation targets.

- **Developing the LNG network**

Legislative Decree No 257 of 16 December 2016, transposing the 'DAFI' Directive and concerning '*Rules for implementing Directive 2014/94/EU of the European Parliament and of*

the Council of 22 October 2014 on the deployment of alternative fuels infrastructure', stipulates, under Article 6, as regards the supply of natural gas for transportation, that by 31 December 2025 in maritime ports, and by 31 December 2030 in inland ports, a sufficient number of LNG refuelling points will have been put in place to allow LNG-fuelled vessels used for inland navigation or LNG-powered vessels used for sea navigation to navigate in the TEN-T Core Network. The same Article also stipulates that by 31 December 2025, a sufficient number of LNG refuelling points also combined with CNG (compressed natural gas) refuelling points will have been gradually put in place, to which the public will have access at least along the Italian sections of the TEN-T Core Network, in order to ensure the circulation of LNG-fuelled heavy-duty vehicles, taking account of the current levels of demand and the short-term development thereof. In Italy, the TEN-T Core Network consists of around 3 300 km of roads in total, divided into three main corridors:

- The Palermo-Naples-Rome-Bologna-Modena-Milan-Verona-Brenner line
- The Genoa-Milan-Chiasso and Genoa (Voltri)-Alessandria-Gravellona Toce lines
- The Fréjus-Turin-Milan-Bergamo-Verona-Padua-Venice-Trieste line

In recent years, following the significant increase in the number of heavy-duty vehicles fuelled by LNG (there are currently around 2,000 such vehicles in circulation on Italian roads), a sizeable number of liquid methane refuelling points have been put in place (there are currently 59 such points in Italy, and a further 41 are planned, according to Federmetano).

Importing LNG as a supply source to complement gas pipeline supplies

Given the increased uncertainty and the possible critical issues – which have all occurred in the past but never all at the same time – arising from disruptions to gas pipeline supplies, the Ministry of Economic Development is actively pursuing a strategy for diversifying and increasing LNG supplies, which currently come almost solely from Qatar and cover around 9% of national gas requirements. The regasification capacity, together with the small scale, will therefore constitute a fundamental factor for Italy as it makes the transition to a completely carbon-free system, since it will make it possible to seize on the opportunities presented by an LNG market that is expected to be in oversupply, probably by the middle of the next decade, and at the same time manage the reduction of imports from southern countries (in particular from Algeria), thus offering supply alternatives for the spot market. In order to increase security, diversification and competition for the Italian gas system, the development of new LNG import capacity may constitute the factor necessary for guaranteeing the presence of more spot supply sources able to compete for the position of marginal source, keeping in line with European prices. In the gas sector various projects for small-scale LNG (SSLNG) coastal storage terminals have already been submitted to the authorities responsible for issuing construction and operating permits (the Ministry of Economic Development and the Ministry of Infrastructure and Transport), to be carried out in Sardinia and on the Adriatic coast (Ravenna and Porto Marghera) and in the Tyrrhenian sea (Naples), for unloading LNG from small methane carriers, storing it and then loading it onto bunker barges and cryogenic tankers in order to refuel civilian and/or industrial customers and supply LNG to fuel stations. In Sardinia two of the three initiatives put forward envisage the coupling of SSLNG and mini regasification units. It will be appropriate and cost-effective to (i) provide natural gas to Sardinian industrial undertakings, citizen distribution networks, whether existing (replacing the current propane gas network) and already compatible with natural gas or under construction; (ii) to replace the fuels used by heavy-duty vehicles; (iii) to replace conventional marine fuels with LNG by gradually introducing a limit of 0.1 % of sulphur content in fuels used by ships at berth in ports and passenger vessels, and (iv) to

supply natural gas to the thermoelectric power plants put in place for the phase-out of carbon fuelled plants. Based on the results of the cost-benefit analysis launched by the RSE for ARERA, which will be available in Spring 2020, more adequate measures will be implemented for transporting natural gas. To offer Sardinian users connected to the distribution network prices in line with the rest of Italy, technical/regulatory solutions will need to be adopted which allow system charges to be levelled and the price of raw material to be correlated to the virtual trading point (VTP). To this end, in order to guarantee Sardinian consumers the requisite level of safety, parity and continuity of supply, consideration will be given to the possibility of connecting coastal storage units being built and authorised and regasification terminals in operation in Italy that will be equipped with a reloading system managed by the TSO, and to adopting a system that correlates the price of raw material to the VTP. In that regard, it should be noted that new projects are under way, including the OLT Offshore LNG regasification terminal in Tuscany that will make it possible to provide, in addition to the other activities it currently carries out, a small-scale service for unloading GNL onto small boats that will refurnish coastal storage facilities and bunkers in Italian ports and ports throughout the Mediterranean, as well as an identical service for the NGL plant in Panigaglia. The direct refuelling of GNL will enable the current mechanism for importing LNG using lorries and foreign terminals to be replaced, fostering the use of LNG as a fuel for maritime and land transport. The authorisation procedure for making the necessary modifications to the plants is being finalised.

ii. Regional cooperation in this area²²

Cooperation with other Member States as part of the TEN-T programme for optimising resources and the overall plans for developing the LNG system for heavy-duty road and maritime transport. Possible setting-up of Sulphur Emission Control Areas, coordinated with neighbouring States.

Other themes of interest which, following meetings with the other Member States in 2019, will be the subject of joint in-depth study are:

- increasing activity in the area of the group gas interconnection in central Europe and south-east Europe (CESEC);
- initiatives for a better coordination of new projects and infrastructure in the Adriatic.

iii. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

Much of the cross-border infrastructure planned for both the electricity sector and the gas sector forms the subject of Projects of Common Interest (PCIs), i.e. infrastructural interventions having positive effects for European countries, which make it possible to integrate EU markets, diversify energy resources and help bring an end to energy isolation. These are projects that concern the electricity and gas sectors: from LNG terminals to energy storage projects, also taking in the electricity power lines and the gas pipelines that connect the countries of Europe. Necessary infrastructure projects recognised as a Project of Common Interest will have greater access to financial support from the Connecting Europe Facility (CEF).

²² Other than the PCI regional groups established under Regulation (EU) No 347/2013.

3.4.3 Market integration

i. Policies and measures related to the elements set out in point 2.4.3

In order to promote greater market integration with other States, the amended text of the law on electrical dispatching (TIDE), in the finalisation phase following consultation (Consultation document 322/2019/R/eel), defines the guiding principles and provides for the following actions:

- **Scrapping the Single National Price (SNP)**

The scrapping of the SNP will be assessed in the medium term, given the management complexities and the operational constraints, which entails the management of the process for integrating European markets through market coupling and greater demand-side participation in the market. For that purpose, consideration will first be taken of the changes in network structures and the need to put in place preventive measures for reducing network congestion and/or the possible economic disadvantages of specific territorial areas, taking into account the increasing market penetration of renewables.

- **Developing market coupling**

Market coupling will continue to be developed – it is already at full speed on the day-ahead market, and is currently evolving on the intraday markets and on the dispatching services market – as regards the implementation of the provisions set out in the applicable European network codes (the CACM and Balancing Regulations). The shift to the target model for the intraday market (continuous trading and near real-time closure) is planned for the second half of 2020, in tandem with the reform of dispatching and the rules on imbalances. Indeed, the intraday market design shared at European level is a hybrid model based on continuous trading, interspersed with three auctions aimed, among other things, at allocating and exploiting trans-zonal residual capacity.

- **Introducing negative prices in the Italian markets**

Italy needs to make up the delay in regulating wholesale prices, also with regard to market coupling, and provide for the possibility of negative pricing. In fact, at the present time, none of the electricity markets in Italy offer the possibility to submit negative price bids, as there is an internal price floor of €0/MWh. Negative prices do occur in several European electricity markets, however. To foster an even better integration with European markets, in accordance with Regulation (EU) 2019/943, which provides that market rules must not constrain pricing in any way, Italy plans to remove the floor, thus allowing negative price bids on the day-ahead and intraday markets.

In fact, the possibility to bid at negative prices will help tackle, according to criteria of economic merit, the excess of supply caused by the lack of flexibility in demand and/or supply of electric energy. This creates conditions in which a producer is prepared to pay for acquire the right to feed electricity into the grid.

Nevertheless, account must be taken of the supply of subsidised generation and the potential market power this implies, given that these aspects could attenuate or even nullify the beneficial effects of introducing negative prices.

In this respect it will be necessary to make sure that, during the hours in which the closing prices on the day-ahead and intraday markets are negative, no incentives associated with loading electricity onto the grid are granted (a scenario already taken into account in the Ministerial Decree of 4 July 2019, RES1), whatever their nature, with the potential to recover them at the end of the entitlement period. In addition, in the case of plants powered by renewable energy sources, any incentives for producing electricity or loading it onto the grid will be granted even if the electricity is input because Terna has accepted offers to decrease input on the dispatching services market or on account of emergency dispatching orders (such as those that lead to wind energy curtailment). Provisions will be made to ensure that incentives not granted are recovered only at the end of the entitlement period (therefore potentially after several years). This would prevent the absence of negative prices on the dispatching services market representing an obstacle to the provision of ancillary services in the case of plants powered by incentivised renewable energy sources.

ii. Measures to increase the flexibility of the energy system with regard to renewable energy production such as smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, re-dispatching and curtailment, real-time price signals, including the roll-out of intraday market coupling and cross-border balancing markets

- **Reorganising and rationalising self-consumption arrangements**

The rolling-out of self-consumption arrangements and, looking further ahead, of energy communities is aimed at promoting a more decentralised electricity system and the active role of distributed generation and demand.

First of all, the self-generation arrangements that can be achieved and the features thereof will be identified, also on the basis of the new EU guidelines. This will allow new, closed-off distribution systems to be produced, and measures will be identified for other private systems connected to plants powered by renewable sources or to high-efficiency cogeneration plants, including those integrated with the stockpile. In this respect, the nature of the entities authorised to implement the measures, the obligations concerning the security of the arrangements, the roles and rights of the individual consumers inside the self-generation systems, the procedures for participating in the markets, and relationships with DSOs and TSOs will all be regulated.

In accordance with the Parliament's delegation of the necessary powers to the Government, and as far ahead as possible of the EU deadlines, within the framework of Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity, amending Directive 2012/27/EU, and the transposal of Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast), standards will be issued that make it possible, in an approach which reflects the decarbonisation targets, to implement direct lines, active customers, citizen energy communities and closed-off distribution systems, self-consumption of energy from renewable sources and renewable energy communities.

- **Supporting self-consumption arrangements**

The exemption of the payment of the variable parts of the charges for energy not taken from the public network is capable of supporting self-generation in the short term, without there being any particular effects to be managed. In close alignment with the reorganisation of the

self-consumption arrangements and the energy communities, the sustainability of that model for collecting network and system charges will be assessed for the purposes of any reforms that may need to be made during the evolution of sector, and to balance the effects of the growth of self-consumption expected by 2030. To that end, absolute priority will be given to ensuring transparency as regards the beneficiaries of the exemption, and the effects of the exemption as regards any possible alterations made to the taxable base will continue to be closely monitored. The procedures for contributing to the costs of the system for the new arrangements, other than those up to 50 kW under the exemption scheme, will however be such as to safeguard the support provided to forms of self-consumption from RES and HEC, also taking account of any possible switch to a system of explicit incentives and fewer requirements for support, owing to the latest drop in the costs of the technologies. The arrangements connected to the public network (physical self-consumption or on the outside perimeter) will continue to contribute towards the network charges.

The measure is described in detail in section 3.1.2.

- **Developing energy communities**

As part of the measures for increasing consumers' active and voluntary participation in the markets, provision has been made, also in implementation of the EU legislation in the course of being adopted, to introduce a set of rules to permit and oversee the development of citizen-led initiatives (with other entities, including companies and municipal authorities, also being able to take part) that bring together new entities aimed at managing, predominantly for the benefit of society, energy consumption and generation levels, including through sharing mechanisms that may even be virtual. To that end, an initial analysis will be carried out in order to identify any impacts that the possible models for implementing the communities and any regulatory aspects (e.g. physical and/or virtual arrangements, geographical perimeter, etc.) may have on the system, in line with the provisions on renewable energy communities (section 3.2.1).

- **Rolling out technology for integrating vehicles with the electricity network (vehicle-to-grid)**

With the expected conversion of the sector to electric power, connected mobility could also become a flexible resource for meeting the needs that arise in managing the network, by developing innovative technologies like vehicle-to-grid. During a first phase, mechanisms and new rules for participating in the service markets for systems for recharging electric vehicles will be introduced, also providing for specific rebalancing measures for payment of the general charges of the system; in that sense, these initiatives will initially be rolled out on a trial basis.

Thereafter, the aforementioned mechanisms will be extensively applied in order to promote the rolling-out of technology for integrating electric vehicles with the electricity network; initial impact assessments will be carried out so as to take account of the results of the trial phase and identify any opportunities for adapting the mechanisms.

The Ministerial Decree setting out the rules for the functioning of vehicle-to-grid is currently being finalised. In the public consultation recommendations were made for solutions or incentives to foster vehicle-to-grid technology or smart recharging, for example by encouraging the installation and proliferation of photovoltaic equipment to power electric vehicle recharging points. Lastly, it will be key to put in place the Single National Platform for localising and using existing infrastructure.

- **Updating the dispatching model and role of distributors (DSOs)**

During a first phase, ARERA will receive guidelines for reforming the operational structure of the dispatching market which, even though within the scope of a central dispatch model, provide for the DSOs to play a more active role by updating their responsibilities with respect to the provision of the network services rendered from the distributed resources and through new models of cooperation between the TSO and the DSOs; this is needed in light of the greater active participation and the resulting greater importance of the distributed consumption and generation resources (including by encouraging the aggregation of installations, potentially starting with pilot projects). In accordance with the approach that is nowadays prevalent both in Europe and Italy, it is deemed appropriate to maintain a model in which the balancing market is managed solely by the TSOs, with the DSOs assigned the role of ‘facilitator’ as regards the dispatching of the resources connected to their networks. In this respect, one specific field of intervention will therefore relate to the procedures and systems in place for allowing the (transmission and distribution) grid operators to communicate with each other; it will also be worthwhile to define new standards of controllability and observability between the transmission network operator the users of the dispatching/balance service provider associated with the new entities participating in the ancillary services market (generation, consumption and storage aggregators).

During a second phase, the gradual progression of the current central dispatch model towards a more decentralised model will be assessed on the basis of technical efficiency and security criteria, so as to take account of the need to manage an increasing proportion of distributed resources and the impetus provided by the new EU rules assigning new responsibilities to the DSOs, such as the provision of flexible services at a local level. In this regard, and taking into account the guidelines indicated by ARERA for reforming the dispatch model, it would be useful to start by taking a gradual approach based on experience gained through pilot projects involving new models that can effectively guide the way towards a reorganisation of roles and responsibilities.

Furthermore, and in line with the guidelines indicated by ARERA in the TIDE, other potential elements aimed at improving, in terms of efficiency, effectiveness and transparency, the functionalities of the dispatching services market will be considered. These include introducing a marginal price system (to substitute the existing pay-as-bid system) for pricing on the market, as well as presenting assessments that could be useful for updating the criteria that Terna will be called upon to use to review the models currently used to optimise dispatching. This will ensure that the models are capable of representing a situation in which flexible resources will be increasingly made available by a plurality of different consumption and/or production units that are aggregated into virtual units.

- **Developing continuous trading in the intraday market**

As part of the changes to the operational structure of the intraday market (IM), and also to enforce the provisions set out under EU law, a procedure for allowing market operators to submit offers up to one hour before the market closes, through continuous trading procedures, will be implemented. These are changes that facilitate negotiations close to real time, by reducing the risks of any disparities in the positions of the operators and promoting increased participation in the market by RES operators, which, owing to the non-programmability of their plants, are mainly exposed to that risk. The reforms will be coordinated with the amendments to the rules governing the dispatching market by the TSO. Specific methods for coordination, including in the form of feasibility constraints on the changes to programmes by the enabled units, will be introduced so that continuous trading

can be carried out in a way that is compatible with the needs that arise from managing the dispatching service and the purchasing of services on that market by the network manager, in conditions of security and keeping costs for the system low.

- **Developing PPAs**

The measure is described in detail in section 3.1.2.

- **Introducing Sulphur Emission Control Areas**

The gradual introduction of a limit of 0.1% of sulphur content in fuels used by ships at berth in ports and passenger vessels.

- **Reducing the energy cost gap for gas-intensive industrial sectors compared with other EU Member States**

The intervention for reducing tariff charges for the industrial sectors most sensitive to energy prices and most exposed to foreign competition consists in putting in place a measure for energy-intensive undertakings, as introduced by the Ministerial Decree of 21 December 2017, for supporting the competitiveness of manufacturing sectors exposed to international competition by adopting efficient consumption parameters at a sector level for the purposes of granting subsidies. The measure is aimed at incentivising the efficient use of gas by gradually reducing the subsidies granted to undertakings classed as energy-intensive owing to the inefficiency of the manufacturing processes, and as a result is aimed at promoting efficient practices.

- **Stabilising taxes for LNG used for transport**

To guarantee a stable reference framework for assisting the investment decisions of the industrial branch of the sector and providing for the excise on natural gas, including in LNG form, used for transport to remain stable, based on current values.

iii. Where applicable, measures to ensure the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets

- **Developing storage capacity**

The development of renewables expected by 2030 has already led the TSO to quantify, in its own Development Plan, the requirements of new storage systems (described in section 2.3 iv) that will be needed, together with the development of the networks, in order to ensure that management is maintained under secure conditions. An assessment of the existing capacities in the different parts of the country and the best locations for storage plants has already been launched, bearing in mind the residual potential of existing water reservoirs. In addition, in line with the Clean Energy Package, steps will be taken to define a new regulatory framework able to promote the development and operability of the new storage capacity needed according to a market model in which stakeholders compete to offer network services that are different from today's (direct management by the TSO of network infrastructure with tariff adjustment). In that respect, the development of storage systems according to a market model is linked to the organisation of ancillary services, which is itself part of the wider reform of dispatching, on the assumption that the objectives of dispatching and the definition of the criteria for supply selection take account of the need to maximise the use of energy generated from renewable resources, reducing overgeneration to a

minimum. To ensure that the storage needs of the system are met in the event of market failure, provision has also been made for the TSO to be able, subject to authorisation from ARERA, and based on the guidelines issued by the Ministry of Economic Development, to construct and operate storage systems directly connected to the national transmission network, but only in the following two cases:

- storage facilities incorporated into the national transmission network and instrumental for managing the security of the electricity system, but which cannot operate on the wholesale markets competing with the market operators that offer balancing services;
- storage facilities capable of providing ancillary services to be supplied to the services market, for which a lack of interest of operators prepared to efficiently provide those services (collapse of the market) has been ascertained following tender proceedings.

- **Reinforcing concentrated storage systems**

In addition to putting new storage systems in place, provision has been made to enhance existing pumping stations, which are currently used predominantly for providing services to the network (power).

From a long-term perspective, in which the proportion of non-programmable RES in the generation mix is destined to exceed 50 %, it is in fact necessary to have those stations operate in such a way as to be able to also offer energy services making it possible to postpone renewable energy production generated in hours (periods of the year) of excess supply and used in hours (periods of the year) of greater demand. In this context, the introduction of market mechanisms for accessing the power of those stations will be assessed.

- **Developing distributed storage systems**

Plans are in place to adopt a specific measure which, in line with the changes to Net Metering (see section 3.1.2, point i.), will allow renewable energy plants that fulfil specific requirements to benefit from a premium on self-consumed energy. The measure, which will be put in place through suitable regulatory provisions, will need to attract distributors by giving them an active role, with the aim of making production from non-relevant entities easier to predict and restricting over-generation.

- **Developing aggregation in the service and balancing markets**

Legislative Decree No 102/2014 introduced the possibility of creating aggregations of power generation plants, including alongside storage systems, and of consumption units for accessing the service markets for which the TSO needs to resolve any possible congestion and promote better integration of renewables.

To that end, during a first phase, the network operator defines the rules for organising the participation in the services market of those new aggregations through pilot projects that are approved by ARERA. In recent years, various types of aggregations between power generation plants and consumption units have been approved, including those with storage systems. In addition, a decree will shortly be approved to launch specific projects for accessing the services market for electric vehicle batteries (V2G), integrating the current possibilities for participating in the pilot projects.

Based on the outcomes of the projects, ARERA will be recommended to move towards a systematic form of control in order to fully open the services markets to those aggregations;

when the measures are implemented, account will need to be taken of the developments under way concerning the Europe-wide integration of the services markets and also of the technological developments allowing the system to be more flexible.

The process for allowing new resources to enter the services market may also entail a review of the services currently defined and of the associated requirements concerning their provision; such a review will also need to take account of the provisions set out in the Balancing Guidelines. New commercial and contractual rules will also need to be developed in order to regulate the relationships between the aggregator entity and the user of the dispatching services or the end customer.

During balancing, the short-term price signals and instruments will need to be improved in order to make distributed generation and demand more flexible, with the aim of enabling the new types of resources to actively contribute to the energy market and the ancillary services market to an even greater extent, and in an efficient way.

iv. Policies and measures to protect consumers, especially vulnerable and, where applicable, energy poor consumers, and to improve the competitiveness and contestability of the retail energy market

- **Completing the liberalisation of the retail markets**

The process for liberalising the retail market by 1 January 2020 will be completed by identifying the measures instrumental in scrapping the regulated price plans for household customers and small businesses, in accordance with criteria for promoting a competitive retail market structure. The initiatives will be put in place in coordination with the natural gas sector.

These actions will need to be aimed at: preventing operators from exercising their market powers (especially in the household segment, which is still the most concentrated segment) and making the rules on unbundling, which currently give a competitive advantage to vendors integrated with distribution, more stringent; qualifying the retail market, which is currently extremely fragmented; encouraging consumers to be mobile and play an active role, and simplifying switching procedures.

- **Instruments and measures for consumer protection**

A number of measures for consumers designed to accompany the liberalisation process in accordance with the above-mentioned objectives have been planned. These incorporate many of the proposals that emerged from the public consultation:

- energy-use portal and other changes to the integrated IT system: the energy-use portal has been online since 2019 on the website of the company Acquirente Unico. The portal provides each consumer, within the limits of privacy laws, data on their own electricity and gas consumption, including general information on their supply contract and energy use over time, thanks to information acquired from the integrated IT system. Going forward, it will be decided whether to make such data available to third parties selected by the consumer. The development of data management tools is also planned, to use and make available to operators data on customers and supply, as well as metering data generated by the responsible entities. Thanks to the integrated IT system, processes for switching, transferring and activating/deactivating the supply, including in cases of overdue payment, will be made easier;

- new forms of non-price protection: a set of forms of protection (code of conduct, contractual conditions under PLACET (contracts with market-based prices but contractual conditions established by the regulatory authority) and other standard contractual conditions) made possible by maintaining and strengthening contractual protection and developing existing instruments, assessing differentiations on the basis of the diverse skills and tools available to end-customers. To this end, specific monitoring will also be carried out to identify over time any price increases not linked to market fundamentals as well as wrongful conduct on the part of operators;
- register of suppliers: in order to do business all vendors of electricity will have to be registered on the list of electricity vendors. This will be established by Decree of the Ministry of Economic Development, as provided for in Law No 124/2017 (Article 1(80)-(81)). To be added to and to stay on the register, suppliers will have to comply with specific criteria and procedures and meet technical, financial and reputational requirements, which will be published and updated on the Ministry of Economic Development's website. To this end, tools will be designed to assess the financial standing of operators and their solvency in terms of payments to end-customers, as well as their capacity to manage the processes and services inherent to their business, especially those with immediate repercussions on customers;
- regulation of services of last resort: there are plans to develop the regulations on selection of operators, conditions of service provision and procedures for entering and exiting those services for end-customers without a free market supplier at the date on which the protection regime ends. This means establishing a safeguarding service for customers who are currently entitled to the Increased Protection service and the potential review of the other last resort services that currently exist;
- other measures: checks and sanctions regarding wrongful conduct, measures of protection for the weakest consumers (also in view of the room for manoeuvre provided by the Clean Energy Package in this regard), enhancing tools for comparing offers (already made available by ARERA and Acquirente Unico), and information campaigns to raise awareness among end-customers are planned. As for preventing wrongful conduct, making operators more responsible, also in relation to sales channels, is becoming fundamental. This will also involve firming up systems for automatically compensating service supply failures on the part of distributors, vendors and managers, to protect consumers in the event of a violation of their rights. Changes are expected to be made to the system of minimum guarantees and mechanisms for recovering outstanding claims from vendors, aimed at guaranteeing revenue for the purposes of the general interest (such as general system charges) and, at the same time, minimising recourse to end-customers to cover outstanding claims.

- **Measure for energy-intensive undertakings**

The development of new renewables will have a lower specific generation cost than the previous phases, especially owing to the reduction in the costs of technologies. This will allow new investments to be made in the market value sector for energy, and possibly include measures for stabilising and reducing the risk of two-way type contracts and the development of PPAs, an instrument that may also meet the needs of many industrial and manufacturing sectors as regards bringing down energy costs whilst stabilising supply conditions. In addition, the measure for energy-intensive undertakings introduced by the Ministerial Decree of 21 December 2017 for supporting the competitiveness of manufacturing sectors exposed to international competition will be supplemented by adopting efficient consumption parameters at a sector level for the purposes of granting

subsidies. The measure aims to encourage the undertakings concerned to adopt efficient behaviours.

- **Tools for ‘prosumers’: the self-consumption portal**

To foster the development of photovoltaic self-consumption, GSE has developed a special IT tool; the Photovoltaic Self-Consumption Portal. The main aims of the portal are to:

1. increase the availability and usability of information on the benefits of, and support tools in place for, photovoltaics;
2. enable an independent and punctual assessment of the initiatives, in order to increase awareness of their potentialities;
3. facilitate and support the launch of photovoltaic projects directed at self-consumption using a simulator, a guide to self-consumption, FAQs, maps and positive examples; these will illustrate the advantages of self-consumption, support tools available and provide examples of models and success stories.

Once they are aware of the advantages of self-consumption, consumers will be able to test how useful it could be in their own individual circumstances. On the portal, private individuals, companies and public bodies can carry out personalised simulations. The analysis provided by the portal shows the size the plant should be and provides an economic evaluation of the initiative, on the basis of various potential financial solutions.

- **Reducing the spread between gas prices at the VTP and the northern European HUB prices**

The Ten-Year Network Development Plans of the Italian TSO (Snam) and the German TSO (TENP) will also include a joint assessment of the possibility of partially or fully reactivating TENP’s deactivated gas pipeline, in cooperation with the Swiss TSO and the German and Italian Regulatory Authorities, by setting out the procedures for carrying out the operation to be funded by the Italian system which, in return for that cost, would obtain a reduction in spread (structurally equal to around €4/GWh for all volumes of gas consumed in Italy).

v. Description of measures to enable and develop demand response including those addressing tariffs to support dynamic pricing²³

- **Electricity and gas market: smart meters**

The new smart meters will play an important role in providing consumers with all the information they need to understand and monitor their energy consumption. From that perspective, these smart meters will be made fully operational, and the necessary network infrastructure will be developed.

For electricity, the replacement of existing digital meters with the new second generation smart meters is a fundamental vehicle for the products, services and offers to be inserted into the new models of generation, distribution and consumption, also from a demand-response perspective, and smart grids.

The 2G meters were defined and regulated in terms of technical, functional and economic requirements by way of Resolution No 646/2006/R/eel for the period 2017-2019. Four million 2G meters have already been put into service for low-voltage users. In 2019 with Resolution No 306/2019/R/eel the regulations in this area were updated for 2020-2022,

²³ In accordance with Article 15(8) of Directive 2012/27/EU.

including a plan for the time frames envisaged for the putting into service of 2G meters for all distribution companies with more than 100,000 customers (corresponding to 98% of extraction points in Italy). The updates provide for the following steps:

- launch of the plans for putting 2G smart metering systems into service by 2022 at the latest;
- the large-scale replacement of existing meters must be finished by 2026 (for 95% of meters, the same percentage used for the first-generation meters). A target of 90% of replacements by 2025 is also set.

For dispatching it will be possible to proceed with a gradual replacement, in line with the plans for activating the new 2G meters, of the mechanisms for profiling the inputs and withdrawals of small-scale users and plants using the measurements made available by new meters to define the physical parts of the dispatching service. In the gas sector the transition to smart metering (Resolution No 669/2018/R/GAS), which makes solutions with better functionalities where the cost differential is kept to a minimum or in any case lower than the expected benefits possible as of now, is expected to be completed according to the following time scale:

- for distribution companies with more than 200,000 end-customers, 85% in service by 31 December 2020;
- for distribution companies with between 100,000 and 200,000 end-customers, 85% in service by 31 December 2021;
- for distribution companies with between 50,000 and 100,000 end-customers, 85% in service by 31 December 2023;
- progressive extension of the replacement objectives to smaller-scale operators as well.

3.4.4 Energy poverty

Generally speaking, the policies for combating energy poverty can be broken down into three groups:

1. policies for reducing the energy bills of families (e.g. social bonuses or tariffs);
2. policies for improving the energy efficiency of households (regulations, tax breaks, energy supply certification schemes, energy tutors, etc.);
3. subsidies to low-incomes families.

Various instruments falling within the first two groups exist in Italy, as shown in the following table. The first group (reducing energy bills) includes electricity and gas social bonuses and two tax deductions on electricity and heating fuel. The electricity and gas social bonuses provide, in the form of a bill discount, an amount that varies as a function of the number of family members and, with respect only to the gas social bonus, also as a function of the climatic zone and the type of use. Families wishing to access those social bonuses must have an income of less than €8,107.50 (as per their Equivalent Economic Status Indicator), increased to €20,000 for large families (with more than three dependent children). As well as these social bonuses, there is also an electricity bill discount available to people reliant on life-saving medical equipment (known as the 'physical ailment social bonus'), which is granted irrespective of income. Those social bonuses collectively totalled €166 million in 2017. In 2018 the total amount granted for the electricity bonus was around €120 million, for the gas bonus around €64 million; between the launch of the mechanism and 31 December 2018, around 2.9 million families benefited at least once from the electricity bonus and

around 1.8 million families benefitted from the gas bonus. In both cases, these values have ample room for growth: the ratio of families effectively subsidised to those who might still benefit from the bonuses is between 30% and 35%, according to ARERA. In order to broaden access to the measure, in the last 12 months measures to coordinate the mechanism with other social policy measures have been introduced. Specifically, within the meaning of Article 5(7) of Decree-Law No 4 of 20 January 2019 (transposed in amended form by Law No 26 of 28 March 2019), those who benefit from the ‘citizenship income’ (or citizenship pension) established by the same Decree have automatic access to the social bonuses for electricity and gas.

As well as the social bonuses, there are also two tax reductions which reduce, respectively, the excise due for the first 150 kWh of electricity consumed per month by Italian families and the price of fuel used for heating in Sardinia and in mountainous areas/small islands.

As regards the measures for improving the energy efficiency of households, there is a tax deduction for the energy refurbishment of buildings (known as the ‘green social bonus’); this instrument has first been extended to families living in energy poverty, with loans initially being made available to individuals having insufficient funds, and then subsequently (the Budget Law for 2018), to independent social housing institutes.

Table 31 – Recipients of the gas and electricity bonus 2015-2018 [Source: ARERA]

Year	Electricity bonus			Gas bonus		Total bonuses granted
	Economic hardship bonus	Bonus holders for purchase card	Physical hardship bonus	Economic hardship bonus		
2015	622,151	22,520	28,267	448,496		1,121,434
2016	622,410	27,624	30,373	448,707		1,129,114
2017	706,969	25,473	32,643	499,808		1,264,893
2018	771,566	23,589	35,903	519,375		1,350,433

i. Where applicable, policies and measures to achieve the objectives set out in point 2.4.4

The priority strategy for combating energy poverty involves several principal measures:

1. setting up a National Observatory of Energy Poverty;
2. reviewing the existing instruments, in particular the electricity and gas social bonuses;
3. subsidies for low income families;
4. putting in place a programme for making social housing buildings more energy efficient.

As regards the first measure, in order to better coordinate existing efforts, and given also the fragmented nature of skills and resources, an Observatory of Energy Poverty is scheduled to be set up by the Ministry of Economic Development at the beginning of 2020. Although the Observatory will be coordinated by GSE at operational level, various entities and institutions will be called upon to take part. The Observatory will act as a focal point on the theme of energy poverty, both nationally and internationally. Among other things, the Observatory will be charged with reporting on and monitoring the phenomenon, as well as helping policymakers identify appropriate policies to fight it, including by measures of

communication, promotion, training and supporting public bodies, operators and stakeholders.

The measure referred to in point 2, namely the review of the gas and electricity social bonuses, will be achieved by pursuing two main objectives:

- reinforcing the two instruments by using a different model for accessing the bonuses based on the ISEE (equivalent economic situation indicator) as provided for by Law 124/2017. That law allows for individual economic benefits to be granted using methods other than cost compensation, identifying a potential joint payment of support measures for the cost of electricity and natural gas supply, and adjusting their amounts on the basis of the equivalent economic situation indicator;
- broadening access of families in living in economic or physical hardship. Specifically, in addition to coordination with the instrument associated with citizenship income described above, plans are in place to introduce an automated mechanism for identifying those entitled to the relief schemes, by combining the existing databases at the company Acquirente Unico (Integrated Information System) and at the National Social Security Institute (Equivalent Economic Status Indicator database). To maximise its effects, this automated mechanism will also be extended to the phase for renewing certificates of entitlement.

This will involve replacing the current electricity and gas social bonuses with a new ‘energy social bonus’, and adjusting the benefit on the basis of the Equivalent Economic Status Indicator and the number of household members; the benefit will be, at most, equivalent to three months’ energy costs (these consisting of both electricity and heating costs) – ideal for covering heating costs (during the winter) or air-conditioning costs (during the summer).

With reference to the bonuses for physical hardship, households with very low ISEE scores will be directly provided with highly technologically efficient equipment that will make application of the bonus more functional and concrete.

The measures to automate recognition of economic or physical hardship, and the resulting simplification and streamlining of the procedures, accompanied by appropriate and wide-reaching training and information campaigns, will play a decisive role in broadening the base of bonus recipients, currently estimated by ARERA to be between 30% and 35% of potential beneficiaries.

As for subsidies for households on low incomes (point 3), a provision entitled ‘energy income’ is being created. This involves setting up a rotation fund for granting capital contributions covering 100% of the cost of investment in photovoltaic installations for domestic use (up to 20 KW).

Among the measures in form of subsidies, there are plans to determine standardised methods of intervention to reduce energy costs for populations affected by exceptional events (for example, the suspension of bills for families affected by earthquakes).

The measure referred to in point 4 involves exploring the option of launching a large-scale programme for making social housing more energy efficient. Such an initiative would pursue a variety of objectives at the same time: making the use of energy resources taken up by the residential sector more efficient (thus having positive effects on both comfort and emission levels), bringing down energy bills for the most vulnerable families who will be using this service, and increasing the value of the public housing assets. These measures will be

accompanied by actions to promote timely local initiatives aimed at reducing energy consumption, such as the creation of energy communities and self-consumption systems.

To incentivise the use of electricity produced using renewable sources and provide support to disadvantaged sections of the population, the Budget Law for 2020 allows instrumental or non-instrumental public bodies and Regions that manage subsidised, residential public housing to use, under given conditions, the mechanism of net metering of the electricity produced by the plants they own, with no power limit applied, to cover their own consumption and that of the residents of the public housing. This waives the obligation to ensure that the place of generation and consumption of the energy exchanged with the network are the same (exchange elsewhere), without prejudice to the payment, at a maximum of 30% of the entire amount, of general system charges. Decree-Law No 124 of 2019, converted into Law No 157 of 19 December 2019 (Tax Law for 2020) provides that from 1 January 2021, persons whose ISEE score is within predefined limits will have automatic access to the social bonus for electricity, natural gas and integrated water system supply. In addition, the Tax Law enables recipients of citizenship income to benefit from the social bonus for water as well as the bonuses for electricity and gas. Lastly, it provides that domestic users who are living in disadvantaged socio-economic conditions can benefit from subsidised tariffs for the integrated urban and related waste management service. The beneficiaries will be identified according to the same criteria used for the social bonuses for electricity, gas and integrated water services.

3.5 Dimension research, innovation and competitiveness

i. Policies and measures related to the elements set out in point 2.5

A series of policies and measures have been put in place to achieve the objectives. The most significant consist of the following Funds:

- **Electric system research fund**

Financed through a levy placed on electricity tariffs (available resources for the 2015-2017 three-year period equal to €210 million), and having the principal objective of supporting both research of general interest (currently carried out by the National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), the National Research Council (CNR) and the energy system research company RSE as part of specific programme agreements), and industrial research. A new Three-Year Plan for 2019-2021 has been approved by Decree of the Ministry of Economic Development of 9 August 2019, which will set new research objectives in line with the SET Plan and the involvement in Mission Innovation. The allocation provided for the three-year period amounts to €210 million, the same as for the previous three years, so as to avoid increasing the burden on the A5 tariff component of the electricity bill.

- **Fund for actions and measures for technological and industrial development**

A fund held at the Fund for Energy and Environmental Services (CSEA), set up by Legislative Decree No 28/2011 and financed through a levy placed on electricity and natural gas tariffs sufficient to ensure resources of around €100 million/year. It aims to support actions and measures for technological and industrial development in the field of renewable sources and energy efficiency. If necessary, the fund may also be called on to support demonstration projects.

- **Fund for the development of intangible capital**

A fund set up by Article 1(c-1091) of the 2018 Budget Law, for the development of intangible capital, competitiveness and productivity, managed by the Ministry of Economic Affairs and Finance, in concert with the Ministry of Economic Development and the Ministry of Education, Universities and Research, which may also be used for financing technological research carried out by companies, in partnership with research bodies, with an allocation increasing up to €250 million for the 2018-2020 three-year period. It may be used to finance activities associated with the involvement in the various technological challenges set out by Mission Innovation.

Additional measures that will play a significant part in achieving the objectives are:

- **Guarantee fund**

Increasing the possibility of being granted a loan: supporting companies and professionals unable to readily be granted a bank loan as they lack the sufficient guarantees.

- **Hyper-amortisation and super-amortisation**

Supporting and incentivising companies that invest in new capital goods and tangible and intangible assets (software and IT systems) instrumental in the technological and digital transformation of production processes.

- **Capital goods ('New Sabatini Law')**

The capital goods measure known as the 'New Sabatini Law' is a facility made available by the Ministry of Economic Development having the objective of making it easier for companies to access credit and increasing competition in Italy's production sector; it supports investments for purchasing or leasing machinery, equipment, plant, capital goods for productive use and hardware, and also software and digital technologies.

The Budget Law for 2020 provides funds of €105 million for 2020, €97 million for each of the years from 2021 to 2024 and €47 million for 2025 for the New Sabatini law, intended to provide subsidised loans for investment in new machinery, plants and equipment, including those that fall within the scope of Industry 4.0, and a corresponding State contribution towards the construction of production facilities, based on the interest calculated on the above-mentioned loans. Furthermore, to increase support for innovative investments by micro- and small businesses in southern Italy, €60 million is set aside for increasing of the State contribution from 30% to 60% for micro- and small businesses that make investments within the scope of Industry 4.0 in Abruzzo, Basilicata, Calabria, Campania, Molise, Puglia, Sardinia and Sicily.

- **'Growth for the South' fund**

The Budget Law for 2020 sets up the 'Growth for the South' fund, with a duration of 12 years, to support the competitiveness and growth of small and medium-sized enterprises in Southern Italy, with an initial budget of €150 million for 2020 and €100 million for 2021, to be drawn from the Development and Cohesion Fund, managed by Invitalia.

- **Tax credit**

This instrument, which forms part of National Industrial Plan 4.0, is for the more immediate use by companies, and is aimed at stimulating private investments in R&D in order to innovate processes and products and guarantee the future competitiveness of the companies (not only in the energy sector). It consists of a 50% tax credit for incremental Research and Development costs, which may be granted up to a maximum annual amount of €20 million per recipient and is calculated on a fixed basis stemming from the average Research and Development costs for the 2012-2014 period. The measure is applicable to Research and Development costs that will be incurred during the 2017-2020 period. The instrument has a capacity of €1.2 billion per year up to 2020, and will also draw on as much additional private funding resources, giving a total of €8-9 billion for the 2017-2020 period. As has been mentioned, the credit is not specifically calibrated to the energy sector, but on the basis of the trends observed, it is estimated that the incremental energy R&D costs will be around €440-500 million.

Regarding the tax credit on the costs of investments in R&D, accessible until 31 December 2020, new provisions have been set out in Law No 160 of 27 December 2019: the bonus will increase from 25% to 50%, for Regions in Southern Italy only.

Table 32 - Estimation of the volumes of investments in R&D during the 2017-2020 period (€bn)
 [Source: compiled by the Ministry of Economic Development using data from the National Institute of Statistics]

	R&D Total	Of which energy R&D
No interventions	50-55	2.5-3
Tax credit	8-9	0.4-0.5
Total	58-64	2.9-3.5

- **Innovation agreements**

Projects concerning industrial research and trial development activities aimed at creating new products, processes or services or significantly improving existing products, processes or services, by developing one or more of the technologies identified by ‘Horizon 2020’ – the EU research and innovation framework programme for the 2014-2020 period.

- **Fund for sustainable growth**

The actions for supporting research and development projects are intended, within the scope defined by the ‘Horizon 2020’ research and innovation framework programme, to back projects seeking to introduce significant technological advancements by developing key enabling technologies (knowledge-intensive technologies associated with high R&D intensity) or technologies that will make it possible to tackle the ‘societal challenges’ defined in accordance with the Europe 2020 strategy.

- **Energy clusters**

In August 2017, the Ministry of Education, Universities and Research (by way of Director’s Decree No 1853 of 26 July 2017) approved the setting-up of public-private research partnerships. The initiative is coordinated by ENEA, and has so far attracted more than 90 public and private entities. It will follow the priority European, national and regional Technological Trajectories, which are characterised by differing technology readiness levels, and will play a part in reaching the research planning targets set out in the SET Plan, the NES, the NRP, the Smart Specialisation Strategy - S3 and the Industry 4.0 project, and through the involvement in Mission Innovation.

- **Proceeds from CO₂ auctions**

The funds available from CO₂ auctions (Legislative Decree No 30/2013) will cover experimental development, in particular in order to ensure that demonstration projects (first-of-a-kind) are supported, with the results being passed on to the production system. In particular, research centres and public administrative bodies have agreed to work together in order to develop the production and use of biofuels in the aviation sector, and ENAC has launched a research project with the aim of producing an alternative fuel derived from microcellular algae.

- **Fund for investments and infrastructural development**

Proceeds from the fund to be distributed according to the provisions set out in Article 1(140) of Law No 232/2016, as refinanced by Article 1(1072) of Law No 205/2017, expenditure: d) research, and to fund Italy's involvement in the Mission Innovation partnership and meet the priorities of the SET Plan. Law No 58 of 28 June (converting the Growth Decree-Law into law): for interventions undertaken to meet the commitments made by the Italian government via the Mission Innovation partnership entered into during the COP21 in Paris, namely to double the share of public investment into research, development and clean energy technology innovation, as well as the commitments made within the framework of the National Integrated Energy and Climate Plan, expenditure of €10 million is authorised for each of the years 2019 and 2020 and €20 million for 2021.

- **National Innovation Fund**

The tool with which the National Fund operates is venture capital, that is, direct and indirect investments in qualified minority shareholdings in innovative companies by means of general funds, vertical funds or funds of funds, to support start-ups, scale-ups or innovative SMEs. The measures aim to cover the whole country, using an investment approach that progresses from seed capital to growth capital. There will be specific interest in technological transfer and sectors that play a strategic role in growth and competitiveness in Italy, such as artificial intelligence, new materials, health, agritech and foodtech, mobility, fintech, made in Italy, design and sustainable industry.

- **Prototype approach that facilitates innovative projects on energy networks**

Definition of a regulatory framework that facilitates innovative projects, including by means of a dedicated fund, allowing operators to conduct tests on site and at prototype stage, if necessary granting temporary waivers from the regulations in force, while at the same time providing for adequate mechanisms for effective cost recognition. Network operators will be particularly involved, activating a new approach of system innovation that involves commercial parties in the development of new business models downstream in the chain and trialling multiservice offers at urban and local level. An example of this is provided by the pilot projects launched by ARERA to foster the participation of distributed resources in the dispatching services market.

- **Cohesion funds**

Pilot projects on a metropolitan/regional scale to demonstrate the financial viability of integrated projects will also be able to be carried out by operators in partnership with Municipalities and Regions, both for the authorisation procedure and in order to promote access to European structural funds. In this respect, there will be greater dialogue with the Regions so that their commitments as regards the use of cohesion funds within the framework offered by the SET Plan fall in line with national priorities.

- **Incentives to support R&D projects for converting production processes in the context of the circular economy**

To encourage businesses to adapt their activities to fit the circular economy model as part of the drive to convert industrial production processes, by Decree of the Ministry of Economic Development, subject to agreement of the Unified Conference within the meaning of Article 3 of Legislative Decree No 281 of 28 August 1997, criteria, conditions and procedures are set out for the authorisation and granting of financial incentives (for example, tax related incentives to provide funding to entities or individuals who have made a commitment to

invest in projects, in particular to achieve energy transition), within the limits of maximum aid grantable under Articles 4 and 25 of Regulation (EU) 651/2014 of the Commission of 17 June 2014, to support development projects aimed at more efficient and sustainable use of resources. Businesses and research centres that, at the date of application for aid, meet the requirements listed in Article 26(2) et seq. of Decree-Law No 34 of 30 April 2019 (the Growth Decree-Law), can benefit from the incentives.

• **Institution of the Ministry of Innovation and the National Research Agency**

The Official Journal of 18 October 2019 publishes the Presidential Decree which grants a mandate to the Minister of Technological Innovation and Digitalisation by creating a special Ministry of Innovation. The new Ministry should merge the current functions of the Bureau of Innovation and Digitalisation, which is part of the Ministry of Public Administration, and the functions of the Department for Digital transformation, recently set up within the Council of Ministers. Although the main tasks of the new Ministry involve digitalisation-innovation and activities at national level, the scope of its mandate is clearly not limited to the digital transformation of government bodies and services, but innovation throughout the whole country.

The Budget Law for 2020 provides for the creation of the National Research Agency, tasked with coordinating scientific research activities in universities (first level) and public research bodies and institutions (second level). Specifically, the Agency is called upon to manage the selection of projects with strategic value, chosen on the basis of criteria and procedures that comply with international best practices, assessing the impact of financed projects, gaging the degree of internationalisation of the research and maximising Italy's presence in the European arena by ensuring compliance with international standards.

• **Fund for investment programmes and innovative projects**

Law No 60 of 27 December 2019 establishes in the statement of estimates of the Ministry of Economic Affairs and Finance a fund with an allocation of €435 million for 2020, €880 million for 2021, €934 million for 2022, €1,045 million for 2023, €1,061 million for 2024, €1,512 million for 2025, €1,513 million for 2026, €1,672 million for each of the years from 2027 to 2032 and €1,700 million for each of the years 2033 and 2034.

The fund is intended for the relaunch of investments of the central government bodies and for national development, also with reference to the circular economy, the decarbonisation of the economy, emission reductions, energy savings, environmental sustainability and, in general, investment programmes and innovative projects. Support can also take the form of contributions to businesses which are highly sustainable, taking account of their social impact.

ii. Where applicable, cooperation with other Member States in this area, including, where appropriate, information on how the SET Plan objectives and policies are being translated to a national context

Italy considers the Strategic Energy Technology Plan (SET Plan) to be a vital tool for tackling new challenges; in the next few years, the SET Plan will constitute the reference point for EU, national, regional and private investments in energy research and innovation.

In Italy, the Ministry of Economic Development and the Ministry of Education, Universities and Research have been tasked with coordinating the SET Plan. Italy has decided to oversee all the working groups set up for organising the Implementation Plans (IPs) concerning the

ten key action areas. The national representatives of each working group have, in turn, set up ‘consultation groups’ made up of representatives from the industrial, research and academic spheres, which are able to contribute significantly to the drafting of the IPs. The Italian delegation works by holding plenary hearings of the main public and private operators in the R&D sector, and also bilateral meetings. It has also been able to count on the support of Italy’s Horizon 2020 (Energy) ‘Enlarged Board’, which consists of around 120 representatives from companies, research bodies, universities, Ministries and Regions, and convenes two or three times each year.

During the extensive work in drawing up the Implementation Plans, Italy has been particularly active in cooperating with other Member States to identify priorities and recommendations with respect to financial requirements. Together with other Member States, Italy is in charge of the following Strategic Priorities of the SET Plan:

- European leadership in the development of innovative renewable energy sources, particularly in the geothermal sector;
- Instruments for allowing consumers to play an active role in the energy transition (smart sector), with particular focus on smart grids;
- new renewable fuels for sustainable mobility.

Possible partnerships on these priority issues with other Member States are currently being looked into, also from the perspective of Mission Innovation. There has also been much cooperation between Member States as part of the Horizon 2020 programme, which places research and innovation measures under a single strategic framework. Italy is one of the most active and forward-thinking countries when it comes to submitting research and innovation proposals, since it is able to count on a vast network of public and private operators and large companies, together with an array of proactive SMEs.

It is hoped that this arrangement will also be able to play a pivotal role in Italy’s participation in the next Horizon Europe Framework Programme, starting in 2021.

iii. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

The principal national financing measures have been given in section 3.5i.

As part of Mission Innovation, Italy, together with other Member States, is committed to doubling the value of the portfolio of resources for public research into clean energy, which needs to be increased, at national level, from around €222 million in 2013 (the year taken as the baseline) to around €444 million in 2021. The main lines of research that are intended to be promoted at national level are described in section 2.5.

In addition to the national and regional financial instruments, Italy believes that, in the run-up to 2030, other EU instruments will play a key role in supporting, above all, the technical-economic demonstration of clean technologies, which is what the EU needs after decades of funding research and innovation projects. Among these, particular importance is attached to the InnovFin Energy Demo Projects (EDP), which constitute instruments specifically for the ‘first-of-a-kind’ projects identified by the SET Plan, and also those vital to demonstration projects, such as the Innovation Fund. Interest has also been shown in the Connecting Europe Facility (CEF) as well as InvestEU and the Juncker Plan itself, in which many Italian companies, and SMEs in particular, have been able to find financial guarantees to support their own

investments. Italian businesses have also shown increasing interest in the Important Projects of Common European Interest (IPCEI) facility, to support value chains identified by the Commission, including in particular those related to batteries and hydrogen, for which new proposals for projects in collaboration with other Member States are being prepared.

- **Italy's participation in the Horizon 2020 Programme**

Participation in the Horizon Programme, which in this context is rapidly evolving in order to reach the targets set, is vitally important to aligning with the priorities of the SET Plan. As regards Italy's contribution to Horizon 2020, in the 2014-2016 three-year period, in the face of strong Italian involvement with over 2 300 operators taking part in tender proceedings, the success rate of Italian-coordinated projects was 9.4 % and the financial contribution for Italy was €112.4 million (7.8 % of the allocated budget).

Following the monitoring carried out by APRE²⁴, Italy's participation over the last few years has improved, also from a forward-looking perspective, with the most notably successful sectors being:

- smart grids and storage systems;
- renewable energy sources (in particular, R&D projects passing from TRL 3-4 to TRL 4-5 and innovation projects passing from TRL 5-6 to TRL 6-7);
- bio-energy;
- energy efficiency (in particular, projects for penetrating the market with products and best practices);
- smart cities and communities (in this case, the economic value of individual projects, such as the project for the city of Florence, is more important than the number of projects).

²⁴ APRE: Italian Agency for the Promotion of European Research

SECTION B: ANALYTICAL BASIS²⁵

CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES^{26,27}

3.6 Projected evolution of main exogenous factors influencing energy system and GHG emission developments

This section gives the assumptions and method for constructing the scenarios devised to support this Plan (baseline and INECP scenarios).

The scenario analysis is built around several ‘critical uncertainties’, which are represented quantitatively by ‘key variables’ that constitute, in short, the fundamental drivers behind the future evolution of the Italian and international energy framework, and in particular: changes in GDP and sectoral Added Values, the human population, and the international prices of fossil fuel sources.

These drivers are chain-linked to and synergised with each other, which means that there is a need to have a consistent source for all the forecasts that will be made.

The European Commission, in its Governance Regulation, in the most recent shared guidelines concerning the forecasts of greenhouse gases, and in the Technical Working Group on National Energy and Climate Plans, suggests using the set of drivers of the ‘PRIMES 2016 (EUref2016)’ scenario in the INECP.

The set of drivers suggested by the European Commission have therefore been used in order to create the scenarios. In particular, it has been decided to use the growth rates of the EUref2016 scenario, by applying them to the most recent historical data available at the time of drawing up the Plan. The predicted evolution of the main drivers is the same for both the base scenario and the INECP scenario.

i. Macroeconomic forecasts (GDP and population growth)

The following table shows the population changes in the scenarios carried out. Starting from the historical value for 2017 (National Institute of Statistics (Istat) – population as at 1 January 2017), the same average annual growth rates of the population provided for in the EUref2016 scenario were used.

²⁵ See Part 2 for a detailed list of parameters and variables to be reported in Section B of the Plan.

²⁶ Current situation shall reflect the date of submission of the national plan (or latest available date). Existing policies and measures encompass implemented and adopted policies and measures. Adopted policies and measures are those for which an official government decision has been made by the date of submission of the national plan and there is a clear commitment to proceed with implementation. The policies and measures implemented are those in respect of which at least one of the following situations applies on the date of submission of the integrated national plan on energy and the climate or of the integrated national intermediary reports on energy and the climate: directly applicable European legislation or national legislation is in force; at least one voluntary agreement has been entered into; financial resources have been assigned; human resources have been mobilised.

²⁷ The selection of exogenous factors may be based on the assumptions made in the EU Reference Scenario 2016 or other subsequent policy scenarios for the same variables. Besides, Member States specific results of the EU Reference Scenario 2016 as well as results of subsequent policy scenarios may also be a useful source of information when developing national projections with existing policies and measures and impact assessments.

Table 33 – Population changes in the baseline and INECP scenarios [Source: historical values: National Institute of Statistics, growth rates: EU Reference Scenario 2016]

	2017	2020	2025	2030	2035	2040
Population (millions)	60.6	61.2	62.2	63.3	64.4	65.4

The following table shows the historical value for 2017 and the growth rates of GDP and sectoral Added Values (AVs) used for the baseline and INECP scenarios. The historical values of GDP and sectoral AVs (source: Eurostat) are given in €m (chain-linked values – reporting year: 2010), while the expected average annual growth rates (%) are those of the EUref2016 scenario. For the short term, the EUref2016 scenario uses the forecasts provided by DG ECFIN (European Economic Forecast, Autumn 2014). The sectoral growth projections for each Member State, for their part, are consistent with the long-term macro-projections and have been obtained from the general economic equilibrium model GEM-E3 used by the Commission.

Table 34 – Changes in GDP and sectoral Added Values under the baseline and INECP scenarios [Source: historical values: Eurostat, average annual growth rates: EU Reference Scenario 2016]

	2017 €m (2010)	% 18-20	% 20-25	% 25-30	% 30-35	% 35-40
GDP	1 599 774	1.37	1.18	1.19	1.5	1.57
Agriculture AVs	28 009	0.78	0.55	0.34	0.44	0.49
Construction AVs	64 524	1.49	0.93	1.22	1.72	1.85
Services AVs	1 077 553	1.47	1.34	1.31	1.63	1.67
Energy sector AVs²⁸	18 931	1.26	0.58	0.91	0.83	1.2
Industry AVs²⁹	260 815	0.93	0.61	0.7	0.9	1.06

ii. Sectoral changes expected to impact the energy system and GHG emissions

The different industrial sectors follow different growth trends. The following table gives the average annual growth rates for the AVs of the main industrial sectors used for the baseline and INECP scenarios. The source of the data is still the EUref2016 scenario.

²⁸ Eurostat – Energy Sector NACE_R2: Electricity, gas, steam and air conditioning supply

²⁹ Eurostat – Industry NACE_R2: Manufacturing + Mining and quarrying + Water supply; sewerage, waste management and remediation activities

Table 35 – Changes in the Added Values of the main industrial sectors in the baseline and INECP scenarios [Source: EU Reference Scenario 2016]

	%	%	%	%	%
	18-20	20-25	25-30	30-35	35-40
Industry AVs	0.93	0.61	0.7	0.9	1.06
Iron and steel	0.43	0.04	0.04	0.23	0.23
Non-ferrous metals	1.13	0.59	0.3	0.32	0.3
Chemicals	1.4	0.96	0.91	1.22	1.42
Non-metallic minerals	1.83	1.51	1.36	1.3	1.5
Pulp, paper and printing	1.17	1.00	0.83	1.06	1.26
Other industries	0.8	0.49	0.67	0.9	0.96

iii. Global energy trends, international fossil fuel prices, EU ETS carbon price

In drawing up the Energy and Climate Plan, reference has been made to the trends in international fossil fuel prices recommended by the European Commission, in particular to the section '*Recommended international fossil fuel prices values as provided in 2017 (without updated deflators, exchange rates etc. and using old conversion rates for units of energy)*'. The price projections of energy commodities on the international markets, used by the European Commission, are derived from simulations carried out via the partial equilibrium model of the world energy system PROMETHEUS on the basis of changes in global demand, resources and reserves of coal, oil and gas, and the associated extraction costs.

 Table 36 – Changes in the international prices of energy commodities³⁰ (€2013/GJ)

	2017	2020	2025	2030	2035	2040
Oil	9.19	11.61	13.18	14.52	15.14	16.04
Gas (PCS)	6.58	7.47	8.08	8.79	9.38	9.7
Coal	1.95	2.21	2.65	3.18	3.36	3.5

In the base scenario, the price of CO₂ for the ETS sector is exogenous and derived from the EU reference 2016 scenario, quantified via the European model PRIMES, and used for European scenarios and the scenarios of all the Member States. The same values have been recommended by the EC for drawing up the Plan. The following table shows the expected changes in the price of CO₂ from 2015 to 2040 according to the values recommended by the EC, even though the current price of CO₂ (value updated in December 2018) is equal to around €20 per tonne.

 Table 37 – Changes in the price of CO₂ (€2013/t CO₂)

	2015	2020	2025	2030	2035	2040
ETS sector	7.5	15.0	22.5	33.5	42.0	50.0

³⁰ Recommended international fossil fuel prices values as provided in 2017 (without updated deflators, exchange rates etc. and using old conversion rates for units of energy)

iv. Technology cost developments

In 2016, a Technical Working Group was set up within the Office of the Italian Prime Minister, bringing together a variety of skills and professions with the aim of systematising and enhancing the different know-how in an interactive and flexible manner.

This Technical Working Group was made up of representatives of the Central Administrations responsible for climate and energy policies (chiefly, the Ministry of Economic Development, the Ministry of the Environment and Protection of Natural Resources and the Sea and the Ministry of Economic Affairs and Finance), experts from leading Research Centres (chiefly, RSE, ENEA, ISPRA, CNR and others, including CMCC, FEEM and CESI), Study Centres (the Bank of Italy Study Centre, the National Institute of Statistics, the Confindustria Study Centre), Universities (Milan Polytechnic) and network and energy system operators (Terna, GSE, Snam).

One of the most important outcomes to emerge from this Working Group was the production of a catalogue³¹ giving a detailed technical and financial breakdown of the available energy technologies, in terms of both supply and final use, that could be of use for advancing the decarbonisation process of the Italian energy system.

In order to construct the baseline and INECP scenarios, use was made of a database of present and future technologies, which had been compiled within the Technical Working Group.

³¹ The report 'Decarbonisation of the Italian economy: catalogue of energy technologies' was published in October 2017.

3.7 Dimension decarbonisation

3.7.1 GHG emissions and removals

i. Trends in current GHG emissions and removals in the EU ETS, effort sharing and LULUCF sectors and different energy sectors

The following table summarises the projections of greenhouse gas emissions up to 2040 with the associated European targets, for the ETS and ESD/ESR sectors. For the latter, the emissions target for 2020 is 291.0 Mt CO₂eq. Taking the emissions of the scenario into account (the 'ESD/ESR sectors' and 'ESD/ESR targets' rows in the table), the target for 2015 has already been achieved and the emissions forecast for 2020 are in line with the target for 2020 being achieved, but the target for 2030 is some way off from being achieved.

Table 38 – National greenhouse gas emissions and European targets (Mt CO₂eq.) – scenario under current policies [Source: Institute for Environmental Protection and Research – ISPRA]

	1990	2005	2010	2015	2020	2025	2030	2035	2040
National emissions	520	581	504	433	419	399	384	374	367
ETS sectors		248	200	156	149	138	137	134	130
ESD/ESR sectors		330	301	274	268	258	245	237	234
Domestic flights not subject to ETS		3	3	2	2	2	2	2	2
ESD/ESR targets*				304	291	243	221		
Difference with respect to targets				-30	-23	15	24		

*Target for 2020 as established by Decision (EU) 2017/1471 (Effort Sharing Decision), target for 2030 as established by the Effort Sharing Regulation, equal to a reduction of 33% of emissions with respect to 2005 levels. The target for 2025 is merely indicative, since it will depend on the emission levels actually recorded during the 2016-2018 period. Emissions of NF₃ are included in the post-2020 ESD/ESR targets.

ii. Projections of sectoral developments with existing national and Union policies and measures at least until 2040 (including for the year 2030)

On the basis of the macro-economic parameters mentioned above, the TIMES model used calculated demand for energy and CO₂ emissions, while the other greenhouse gas and emissions from non-energy sectors are calculated based on the estimated changes of the associated activities, with average emission factors. Emissions up to 2015 are to be inventoried as having been notified to the UNFCCC in 2017.

The data show a marked reduction in emissions from 2005 up to 2015, and a subsequent decrease at more modest reduction rates. The reduction in emissions is down to many factors, some being structural and others contingent. The most important of these are:

- a greater-than-expected renewable energy share in primary consumptions, following the strong development of photovoltaic energy production and the increased use of biomass for heating;
- an increase in the efficiency of electricity generation, with a large number of combined-cycle (and in most cases cogeneration) power plants fuelled by natural gas entering into operation, together with the gradual phasing-out of obsolete steam plants powered by fuel oil;
- a reduction in transport consumption levels, owing to the joint initiative for raising

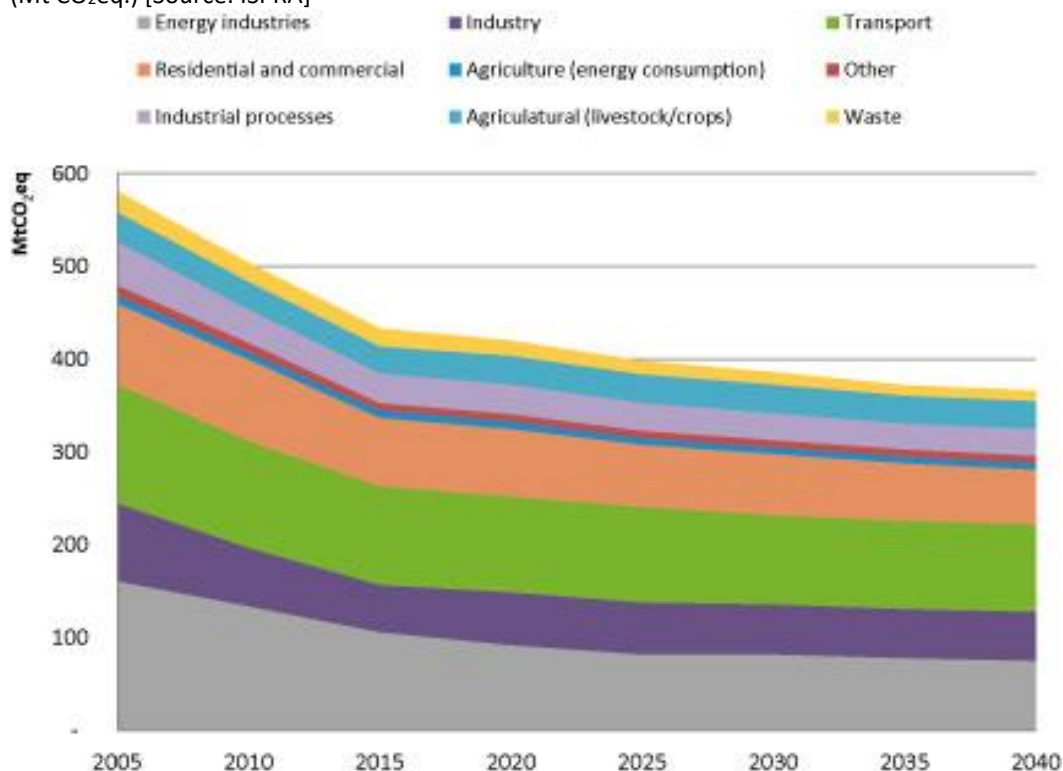
- fuel prices and low levels of activity;
- a rapid reduction in final consumption levels in the industrial sector, following the financial crisis and the structural changes made to manufacturing activities;
- an increase in the efficiency of the items of equipment actually using the energy generated.

The following table and graph show how the scenario is predicted to evolve up to 2040. Emissions are divided by sector.

Table 39 – Greenhouse gas emissions (historic up to 2015) according to the base scenario, divided by sector (Mt CO₂eq.) [Source: ISPRA]

GHG emissions, Mt CO ₂ eq.	2005	2010	2015	2020	2025	2030	2035	2040
FROM ENERGY CONSUMPTION, of which:	480	417	353	341	324	312	304	297
Energy industries	161	134	106	92	82	82	78	75
Industry	84	63	51	56	56	53	53	53
Transport	128	115	106	103	103	96	95	94
Residential and commercial	87	88	74	73	67	66	62	59
Agriculture	9	8	8	8	7	7	7	7
Other	11	10	8	8	8	8	8	8
FROM OTHER SOURCES, of which:	101	87	80	78	75	72	69	70
Industrial processes	47	36	32	32	30	29	28	29
Agriculture	32	30	29	31	31	31	30	30
Waste	22	20	19	16	14	13	11	11
TOTAL	581	504	433	419	399	384	374	367
Of which subject to ESD/ESR	330	301	274	268	258	245	237	234

Figure 42 – Greenhouse gas emissions (historic up to 2015) according to the base scenario, divided by sector (Mt CO₂eq.) [Source: ISPRA]



The sectoral analysis for the 2015-2030 period shows that:

- there is a significant reduction in emissions from the energy industries (down 23%), mainly due to the reduction in emissions from the electricity sector. The emissions produced by the latter sector are directly linked to the production of electricity from fossil fuels. The significant rise in electricity production from renewable sources and the increase in thermoelectric efficiency since 2008 have played a part in reducing emissions, which has also contributed significantly to the increase in thermoelectric efficiency. The projected reduction in emissions over the years ahead is due to a further increase in thermoelectric efficiency and in the share of energy from renewable sources, and to an increase in the share of fuels containing low levels of carbon;
- in the transport sector, the projections show a reduction in emissions of 9% following the implementation of the measures in force, despite there being an increase in transport demand;
- in the civil sector, emissions are down by 11%, mainly due to increased efficiency; the increase in emissions recorded over the past few years is essentially down to the expansion of the building stock in the tertiary and residential sector (second and third homes); in addition, the increase in the average size of homes and the greater demand for heating have both played a decisive role. The policies planned for the years ahead are expected to have a significant impact for reducing emissions;
- emissions from the industrial sector, concerning both energy consumption and processes, decreased dramatically between 2005 and 2015 (down 36%), due in part to the financial crisis and in part to the structural changes made to the activities and the greater efficiency of manufacturing processes, the effects of which are also clear as regards the reduction in emissions anticipated over the years ahead. Indeed, emissions from the industrial sector are expected to remain fairly stable over the 2015-2030 period, despite an upturn in production levels;
- emissions from waste are expected to reduce the most between 2015 and 2030 (down 31%), mainly due to less waste being sent to landfill sites.
- agriculture is the sector showing the most stable progress, with the measures already put in place not having a great impact on the sector, the total emissions of which are forecast to decrease by around 8% over the period under examination, although increases might be observed in several years' time.

The following table shows emissions by type of gas in terms of CO₂eq. CO₂ constitutes around 84% of all emissions. It is worth pointing out that, although other gases have played a part in reducing overall emissions, their role has tended to gradually increase over time, passing from 15% in 2005 to more than 17% by 2015. As has already been noted, the reduction in methane is due first and foremost to the waste sector. The reduction in HFC and SF₆ emissions is mainly down to the implementation of Regulation (EU) No 517/2014 on F-gases.

Table 40 – Greenhouse gas emissions from 2005 to 2040, divided by gas (Mt CO₂eq) [Source: ISPRA]

GHG emissions	2005	2010	2015	2020	2025	2030	2035	2040
Carbon dioxide	495	425	355	343	328	317	310	304
Methane	48	47	43	41	39	38	36	36
Nitrous oxide	28	19	18	19	18	18	18	18
HFCs	7.1	11.4	14.5	14.1	11.6	9.2	7.4	7.4
PFCs	1.9	1.5	1.7	1.6	1.6	1.6	1.6	1.6
SF ₆	0.6	0.4	0.4	0.3	0.3	0.3	0.3	0.3
NF ₃	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	581	504	433	419	399	384	374	367

3.7.2 Renewable energy

i. Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors

The following table shows how the overall RES target (share of gross final consumption of energy covered by renewable sources) has evolved over time, calculated by applying the criteria set by the RED I. In 2017, energy generated from RES increased to 22 Mtoe, giving a share of total gross final consumption of 18.3%; the contribution from the electricity sector increased to 44% of total RES, while those of the thermal sector and the transport sector stood respectively at 51% and 5%.

Table 41 – Total RES target (ktoe) [Source: GSE]

	2012	2013	2014	2015	2016	2017
Numerator – Energy from RES	19 618	20 737	20 245	21 286	21 081	22,000
Gross electricity production from RES	8 026	8 883	9 248	9 435	9 504	9 729
Final RES consumption for heating and cooling	10 226	10 603	9 934	10 687	10 538	11 211
Final RES consumption for transport	1 366	1 250	1 063	1 164	1 039	1 060
Denominator – Total gross final consumption	127 052	123 869	118 521	121 456	121 053	120 435
Overall share of RES (%)	15.4%	16.7%	17.1%	17.5%	17.4%	18.3%

Electricity sector

In 2017, electricity production from RES, calculated by applying the calculation criteria set by the RED I (normalised hydro and wind production, sustainable bioliquids) slightly exceeded 113 TWh; the contribution to total national gross electricity production was 34.1%.

Table 42 – RES target for the electricity sector (TWh) [Source: GSE]

	2012	2013	2014	2015	2016	2017
Numerator – Gross electricity production from RES	93.3	103.3	107.6	109.7	110.5	113.1
Hydro (normalised)	44.1	45.0	45.8	45.9	46.2	46.0
Wind (normalised)	12.4	14.1	14.9	15.3	16.5	17.2
Geothermal	5.6	5.7	5.9	6.2	6.3	6.2
Bioenergies	12.3	17.0	18.7	19.4	19.4	19.3
Solar	18.9	21.6	22.3	22.9	22.1	24.4
Denominator – Gross inland electricity consumption	340.4	330.0	321.8	327.9	325.0	331.8
RES-E share (%)	27.4%	31.3%	33.4%	33.5%	34.0%	34.1%

Thermal sector

In 2017, the consumption of RES in the thermal sector stood at around 11.2 Mtoe; the share of total national thermal consumption neared 20%. The greater RES contribution was provided by the consumption of solid biomass (mainly firewood and pellets used in the residential sector) and the use in winter of heat pumps.

Table 43 – RES target for the thermal sector (ktoe) [Source: GSE]

	2012	2013	2014	2015	2016	2017
Numerator – Energy from RES	10,226	10,603	9,934	10,687	10,539	11,211
Gross heat production derived from RES	592	838	966	905	928	957
Final RES consumption for heating	9,635	9,765	8,968	9,783	9,611	10,255
<i>of which bioenergies</i>	6,946	6,959	6,097	6,894	6,677	7,265
<i>of which solar</i>	155	168	180	190	200	209
<i>of which geothermal</i>	118	119	111	114	125	131
<i>of which ambient energy from heat pumps</i>	2,415	2,519	2,580	2,584	2,609	2,650
Denominator – Gross final consumption in the thermal sector	60,214	58,606	52,519	55,504	55,796	55,823
RES-H share (%)	17.0%	18.1%	18.9%	19.3%	18.9%	20.1%

Transport sector

The changes in the RES target as regards the transport sector, as illustrated in the following table, have been calculated by applying the calculation criteria set in the RED I (the incentivising coefficients are given in the same table). In 2017, the sectoral consumption of energy from RES thus calculated amounted to slightly less than 2 Mtoe; the associated impact on total consumptions neared 6.5%.

Table 44 – RES target for the transport sector (ktoe) [Source: GSE]

	coeff.	2012	2013	2014	2015	2016	2017
Numerator – Energy from RES		2,019	1,741	1,678	2,121	2,377	1,992
Advanced double-counting biofuels	2.0	62	8	14	13	9	7
Non-advanced double-counting biofuels	2.0	277	107	172	439	765	350
Single-counting biofuels	1.0	1,026	1,136	878	713	265	703
Renewable share of electricity on the road network	5.0	1.0	1.3	1.6	1.9	2.0	2.4
Renewable share of electricity on the rail network	2.5	82.8	101.9	117.2	137.4	156.5	158.7
Renewable share of electricity on other modes of	1.0	102.0	114.9	127.9	152.9	162.3	166.4
Denominator – Gross final consumption in transport		33,110	32,176	33,431	32,611	32,057	30,728
RES-T share (%)		6.1%	5.4%	5.0%	6.5%	7.4%	6.5%

ii. Indicative projections of development with existing policies for the year 2030 (with an outlook to the year 2040)

In terms of RES development during the 2020-2040 period, the following tables show, respectively, how the current policies concerning the total RES target, the RES-E target, the RES-H target and the RES-T target will evolve over time. According to the trends up to 2030, RES will contribute 21.1% of final gross energy consumption, three percentage points up from the historical data for 2017 (18.3%). As regards the outlook to 2040, the share in RES is expected to increase by a further percentage point to 22.2%.

Table 45 – Total RES target for the 2020-2040 period with existing policies (ktoe)

	2020	2025	2030	2040
Numerator	22,944	23,598	25 242	26 858
Gross electricity production from RES	10,183	10,364	11,348	12,284
Final RES consumption for heating and	11 121	11,301	12 008	12,825
Final RES consumption for transport	1,640	1,933	1,886	1,749
Denominator – Total gross final consumption	120,479	120,399	119,069	121,001
Overall share of RES (%)	19.0%	19.6%	21.2%	22.2%

Electricity sector

Under existing policies, provision has been made for energy produced from RES to contribute 11.3 Mtoe to the electricity sector by 2030, equal to 132 TWh, with a coverage of the final gross electricity consumption from renewable energy of 38.7%, as opposed to 34.1% in 2017. Analysing the individual sources, the significant residual potential that is technically and financially exploitable and the reduction in costs in the photovoltaic and wind sectors also point towards progress being made to current policies in respect of those technologies. Still within the same time span, a contained increase in the additional geothermal and hydroelectric power is expected, along with a slight drop in bioenergies, not including bioliquids for which, conversely, a gradual rolling-out of power plants for incentive purposes is anticipated. As regards the outlook to 2040, the share in RES-E is expected to increase up to 40.6%.

Table 46 – RES-E target for the 2020-2040 period with existing policies (TWh)

	2020	2025	2030	2040
Renewable production	118.5	120.5	132.0	142.9
Hydro (normalised)	49.4	49.1	51.0	51.6
Wind (normalised)	20.1	21.8	25.1	33.2
Geothermal	6.7	6.9	7.0	8.3
Bioenergies	16.3	14.7	14.2	12.3
Solar	26.0	28.0	34.6	37.4
Denominator – Gross inland electricity consumption	327.1	333.1	340.6	351.7
RES-E share (%)	36.3%	36.2%	38.7%	40.6%

Thermal sector

The thermal sector will also play an important role in developing current policies concerning renewables: in absolute terms, provision has been made, in fact, to reach around 12 Mtoe of RES in the heating and cooling sector by 2030, linked mainly to increasing the renewable component of annual heat pumps. In 2030, the thermal sector will make use of thermal solar and geothermal plants and bioenergies³² (for a total of 7.8 Mtoe), heat pumps (3.5 Mtoe) and cogenerated heat produced from RES (0.7 Mtoe). In 2030, the share in RES-H will reach 23.8%, as opposed to 20.1% in 2017. As regards the outlook to 2040, the share in RES-H is expected to increase up to 25.4%.

Table 47 – RES-H target for the 2020-2040 period with existing policies (ktoe) [Source: RSE]

	2020	2025	2030	2040
Numerator	11 121	11 301	12 008	12 825
Gross heat production derived from RES	785	682	709	701
Final RES consumption for heating	10 336	10 619	11 299	12 124
<i>of which bioenergies</i>	<i>7 011</i>	<i>6 949</i>	<i>7 132</i>	<i>7 456</i>
<i>of which solar</i>	<i>300</i>	<i>502</i>	<i>518</i>	<i>595</i>
<i>of which geothermal</i>	<i>145</i>	<i>148</i>	<i>150</i>	<i>150</i>
<i>of which ambient energy from heat pumps</i>	<i>2 880</i>	<i>3 020</i>	<i>3 499</i>	<i>3 923</i>
Denominator – Gross final consumption in the thermal	53 160	51 405	50 432	50 483
RES-H share (%)	20.9%	22.0%	23.8%	25.4%

Transport sector

In the projections concerning current policies, account has not been taken of the new objectives fixed by the RED II, which sets a specific 2030 target of 14% in the transport sector (an obligation which Member States will need to pass on to fuel suppliers). A RES share of 11.3% is expected to be reached in the transport sector in 2030 (calculated according to the criteria laid down by the RED II), which may be put down to an increased consumption of both biofuels and electricity by road and rail transport. As regards the outlook to 2040, the share in RES-T is expected to increase up to 12.6%.

³² Including biomethane and biogas

Table 48 – RES-T target for the 2020-2040 period with existing policies, but with calculation criteria laid down according to the rules of the RED II (ktoe) [Source: RSE]

	Multiplication factor	2020	2025	2030	2040
Numerator		2 841	3 247	3 381	3 674
Advanced biofuels	X 2	193	295	323	503
Non-advanced double-counting biofuels	X 2	700	670	650	650
Single-counting biofuels		747	968	913	596
Renewable share of electricity on the road network	X 4	7	9	40	74
Renewable share of electricity on the rail network	X 1.5	187	209	242	316
Denominator – Gross final consumption in transport		31 859	30 856	29 894	29 195
RES-T share (%)		8.9%	10.5%	11.3%	12.6%

3.8 Dimension energy efficiency

i. Current primary and final energy consumption in the economy and per sector (including industry, residential, service and transport)

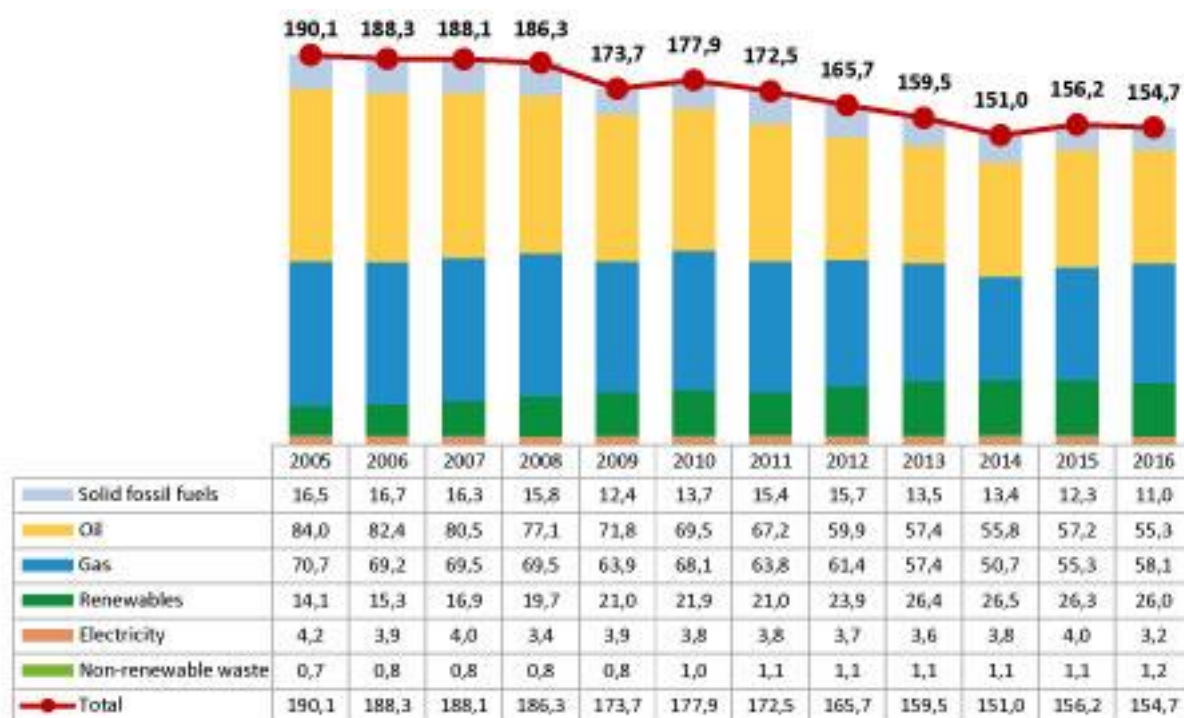
The last few decades have seen profound changes being made to the Italian energy system, in which natural gas first of all established itself, followed by (from 2005 onwards) a marked rise in renewable energy sources, in particular in the electricity sector, and a steady reduction, on the other hand, of petroleum products. These developments have been imposed both by policies aimed at significantly reducing greenhouse gas emissions and thus combating the risks associated with climate change, and by the need to guarantee greater security and diversification in energy supplies.

In 2016, gross inland consumption stood at around 155 Mtoe³³, down by one percentage point with respect to the previous year. This figure stems from a constant reduction, with respect to the previous year, in the consumption of solid fuels (down 10.7%), petroleum products (down 3.3%) and RES, which have seen a reversal in their growth (down 0.1%), together with an increase in gas consumption (up 5%). Net electricity imports dropped to around 20%.

Gross inland consumption and final consumption levels fell dramatically in the 2005-2014 period, save for an upturn in 2010, followed by a slight drop in recent years. The falls in the consumption of petroleum products, natural gas and (albeit at an inconsistent rate) coal have been particularly marked. Over the last few decades, renewable energy sources, also thanks to a generous incentivisation scheme, have played a leading role in a period of significant development in Italy; this period ended in 2013, after which progress has been rather stagnant, with a fall, as mentioned above, being recorded in 2016.

³³ Including non-energy uses – Source: Eurostat

Figure 43 – Changes in gross inland consumption per source (Mtoe) [Source: Eurostat]

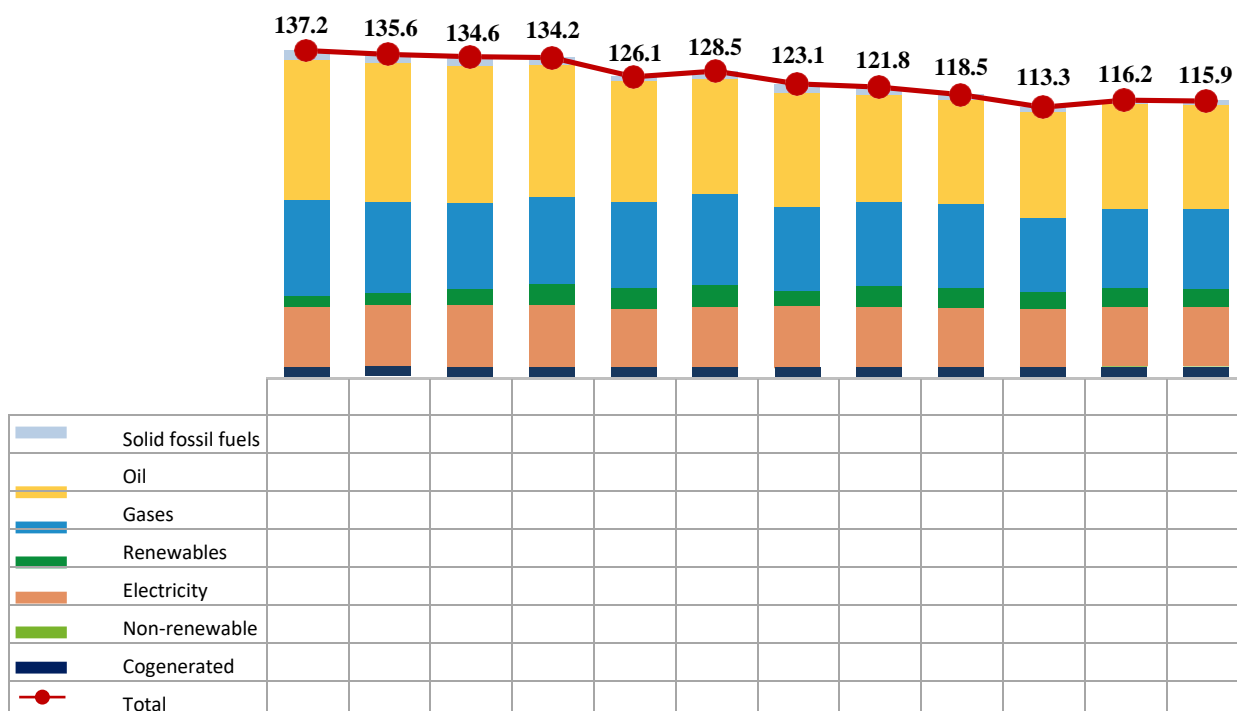


Primary energy demand (excluding non-energy uses) in the period 2005-2016 decreased by 18% from 181.5 Mtoe in 2005 to 148.4 Mtoe in 2016.

In 2016, final energy consumption levels recorded a slight drop in relation to the previous year, falling 0.3% to 116 Mtoe. The following can be seen:

- a less marked but still significant fall in consumption by the transport sector (down 1.1%);
- broadly stable consumption levels for the civil sector (down 0.5%), but linked to climate variability;
- increased consumption by the industrial sector (up 1.4%).

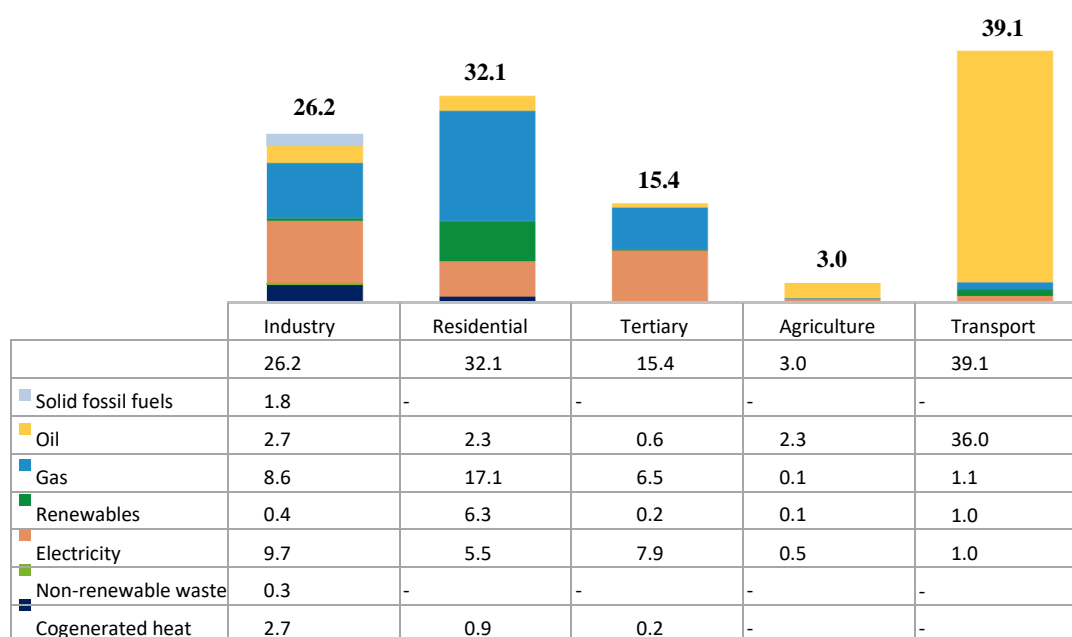
Figure 44 – Changes in final consumption levels per source (Mtoe) [Source: Eurostat]



The trend in final consumption levels shows that the energy mix has remained substantially the same in recent years. As can be seen, gas and electricity sources are predominant in the industrial sector (around 70% of total consumption) and the civil sector (85%), while oil covers virtually all the requirements of the transport sector, although it is worth pointing out an increase in RES in relation to the use of biofuels.

The following figure details the final sectoral consumption levels in 2016, by source. It should be noted that most final consumption is for civil uses (41%), followed by the transport and industrial sectors (34% and 22%, respectively).

Figure 45 – Final energy consumption levels per source and sector, for the year 2016 [Source: Eurostat]



In terms of energy efficiency, and with respect to the objective set out in the 2014 Energy Efficiency Action Plan (EEAP) for the 2011-2020 period, post-2017 energy savings are slightly greater than 8 Mtoe/year, equivalent to 52% of the final objective. Around 37% of these savings originate from the mandatory White Certificates scheme, and more than a quarter from tax deductions. From a sectoral perspective, the residential sector has in fact already achieved the objective set for 2020, while the industrial sector is halfway along the scheduled route.

Table 49 – Subsequent annual energy savings per sector, for the 2011-2017 period, and expected in 2020 (Mtoe/year), in accordance with the 2014 EEAP [Source: WEEE 2018]

	White Certificates	Tax deductions	'Conto Termico' (Thermal Energy Account)	'Impresa 4.0' (Company 4.0)	Community and High Speed Regulations	Legislative Decrees No 192/05 and of 26 June 2015	Energy savings		Objective achieved (%)
							Post-2017	Expected in 2020	
Residential	0.71	2.08	-	-	-	0.85	3.64	3.67	99.2%
Tertiary	0.15	0.02	0.005	-	-	0.04	0.22	1.23	17.9%
Industry	2.1	0.03	-	0.3	-	0.07	2.5	5.1	49.0%
Transport	0.01	-	-	-	1.68	-	1.69	5.5	30.7%
Total	2.97	2.13	0.005	0.3	1.68	0.96	8.05	15.5	51.9%

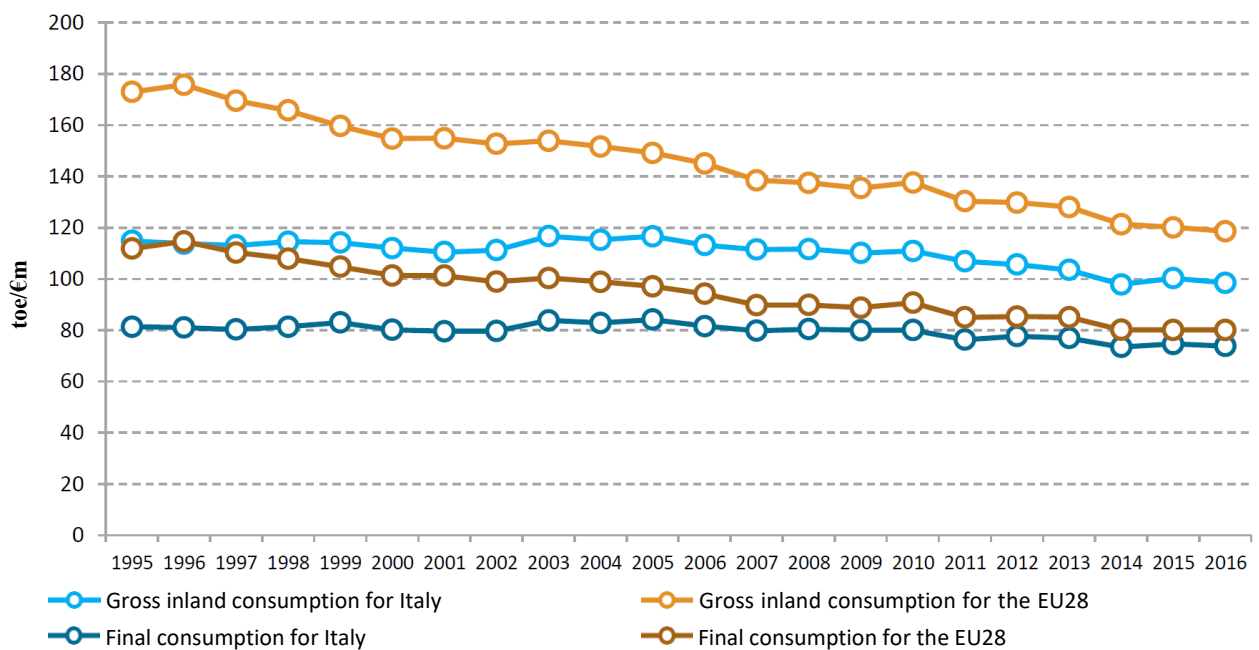
The savings recorded for the residential and industrial sectors and by measures such as the White Certificates and tax deductions have been prevalent in recent years, but since they are mature schemes, they have a limited scope for growth, unlike the schemes recently adopted ('Conte Termico' (Thermal Energy Account), 'Piano Industria 4.0' (Industry Plan 4.0) and others yet to be promoted.

Energy intensity – historical analysis up to 2016

Energy intensity, which is assessed in terms of energy consumed per unit of economic wealth generated (GDP, chain-linked values, reporting year: 2010), is an indicator of economic and energy efficiency. Italy's energy intensity is one of the lowest in Europe. Based on Eurostat data, Italy still has the lowest energy intensity per unit of wealth generated amongst the major European countries, after the United Kingdom.

Final energy intensity is following similar trends. The following figure shows how the average European intensity has fallen sharply, approaching levels that Italy has had since 1990. Historically, Italy's energy and economic efficiency has been greater than the average of the other countries of Europe, which has required a major effort to achieve significant energy savings with respect to other economies in which specific consumption levels are historically higher and more compressible. Consumption levels first started falling in 2005, before the financial crisis, whereas they had constantly been on the rise between 1990 and 2005, by an average annual rate of +1.4%. In addition, the share of natural gas has constantly been on the rise since 1990, offsetting the corresponding drop in petroleum products. The increasingly important role played by renewable energies has become clear in recent years.

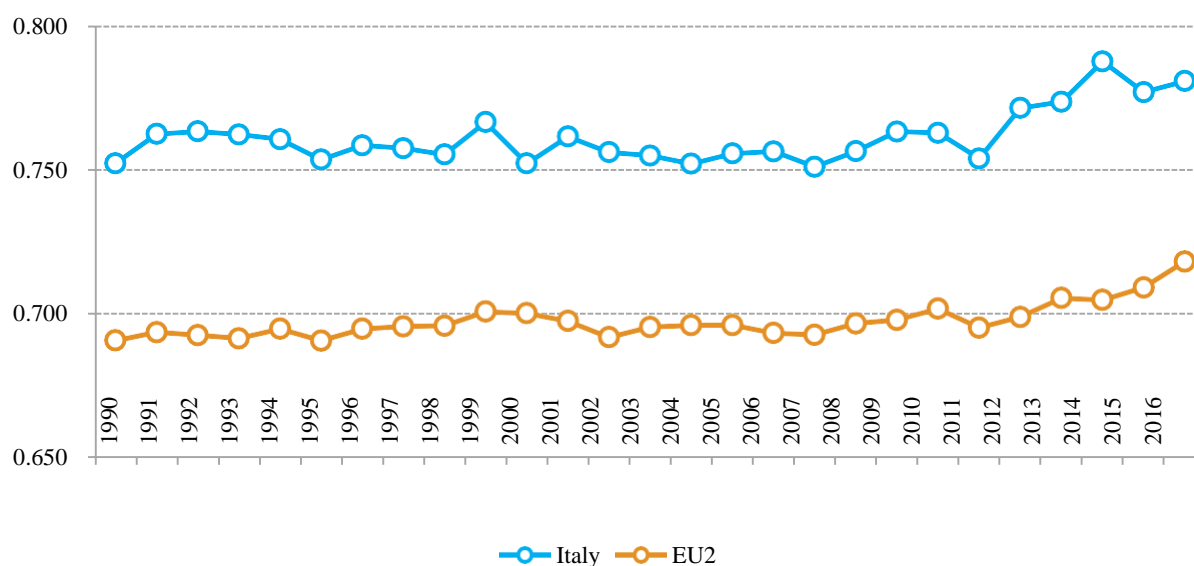
Figure 46 – Final consumption and gross inland consumption per unit of GDP, historical data



The ratio between final energy consumption and primary energy consumption is an indicator of the overall efficiency of converting energy from primary sources. This ratio has always been very high for Italy, and greater than the European average. The increase in efficiency, which is also due to the increase in gross electricity production from cogeneration plants (since 1999), is partially offset by the growing importance of secondary energy sources (electricity, petroleum derivatives) in final energy consumption; this explains why the indicator was relatively stable up to 2011. The ratio has increased in recent years, owing not only to the increase in the share of final electricity consumption, but also to the greater efficiency in transforming fossil fuels.

Since 1990, the average ratio between final energy consumption and primary energy consumption in Italy has fluctuated between 0.7 and 0.75, with the average figure for the EU28 standing at around 0.65.

Figure 47 – Final consumption per unit of gross inland consumption, historical data



Electricity transformation efficiency

Each year, Terna publishes data concerning energy consumption levels, specific consumption levels and the production of useful electricity and heat by thermoelectric power plants, which make it possible to formulate parameters on the efficiency of those plants in terms of the ratio between the energy produced and the energy content of the fuels used.

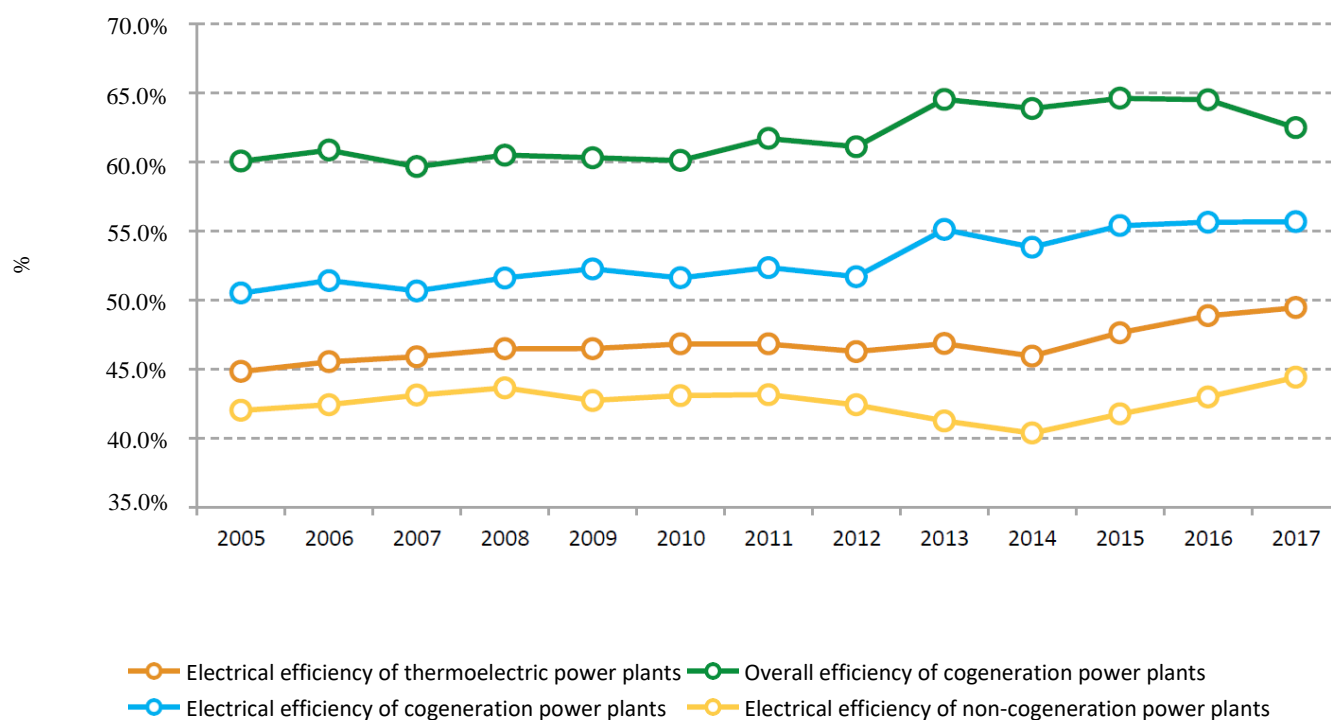
The following table gives the parameters relating to the energy consumed by Italy's thermoelectric power plants and the efficiency of those plants. The figures show that the efficiency of Italy's thermoelectric power plants has increased since 2005, above all due to the contribution made by the cogeneration power plants, which have greater electrical efficiency than non-cogeneration power plants. In 2016, the electrical efficiency of the latter plants was 43%, whereas the former plants recorded a figure of 55.6%. In addition, the electrical efficiency of cogeneration power plants is constantly increasing, while that of non-cogeneration plants has not significantly risen since 2005. In 2016, cogeneration power plants recorded an efficiency level of 64.5% (taking heat production into account as well). The overall efficiency of Italy thermoelectric power plants is 54.6%, and has followed an upward trend in recent years (up to 2016).

Table 50 – Energy consumption and efficiency levels of Italy’s thermoelectric power plants

	2005	2010	2011	2012	2013	2014	2015	2016
Specific consumption levels – non-cogeneration power plants (Mcal/electric kWh)	2.048	1.997	1.993	2.028	2.085	2.131	2.060	2.001
Specific consumption levels – cogeneration power plants (Mcal/electric kWh)	1.703	1.667	1.643	1.664	1.561	1.598	1.553	1.546
Energy consumption – thermoelectric power plants (ktoe)	53 468	47 764	47 671	45 666	41 099	38 300	40 343	40 886
- cogeneration power plants	21 206	23 999	22 521	22 147	20 052	19 045	20 654	22 164
- for electricity production	16 078	18 577	16 678	16 780	14 251	13 607	14 889	16 256
- for heat production	5 127	5 422	5 843	5 367	5 801	5 438	5 765	5 908
- non-cogeneration power plants	32 262	23 765	25 150	23 519	21 046	19 256	19 688	18 722
Energy consumed for electricity production [ktoe]	48 339	42 342	41 830	40 300	35 295	32 856	34 578	34 978
Electrical efficiency of thermoelectric power	0.448	0.468	0.468	0.463	0.468	0.459	0.476	0.488
Overall efficiency of cogeneration power plants	0.600	0.601	0.616	0.611	0.645	0.638	0.646	0.645
Electrical efficiency of cogeneration power plants	0.505	0.516	0.523	0.517	0.551	0.538	0.554	0.556
Electrical efficiency of non-cogeneration power	0.420	0.431	0.431	0.424	0.412	0.403	0.417	0.430
Overall efficiency of thermoelectric power	0.491	0.516	0.519	0.515	0.526	0.520	0.534	0.546

The following figure shows how the efficiency levels of Italy’s thermoelectric power plants (broken down into cogeneration and non-cogeneration power plants) have progressed over the years. The increase in efficiency recorded for the cogeneration power plants between 2012 and 2013 is particularly striking; this was down to the predominant operation of combined-cycle and condensation cogeneration units that were substantial in size and more efficient.

Figure 48 – Efficiency of Italy's thermoelectric power plants, from 2005 to 2016



The data show that the conversion efficiency levels recorded in 2016 are greater than those recorded in 2005. The increased efficiency is particularly pronounced for cogeneration power plants; indeed, between 2005 and 2016, the average increase in electrical efficiency recorded for all thermoelectric power plants was 4%, but when the figures are broken down, it emerges that cogeneration power plants achieved an increase in efficiency of 5.1%, compared with just 1% for non-cogeneration power plants over the same period.

As regards overall efficiency, cogeneration power plants saw their performance levels go up by 4.4%, with a particularly significant role being played by combined-cycle power plants, which managed to increase their overall efficiency by 7.3%.

Efficiency in sectors making final use of energy

The final energy intensity (final energy consumption divided by added value produced) of the Italian industrial sector from 1995 to 2016 was always below the European average. In addition, between 2005 and 2015, Italy's average annual rate of reduction in energy intensity (-2.9%) was second only to that of Poland (-6.1%), which nevertheless recorded values that were particularly high compared with other European countries.

For the services sector, there has been little variation since 2005. The average annual rate of increase for Italy has been low – around 0.1%. In 2015, Italy recorded the 8th highest energy intensity in relation to services, out of the 27 countries making up the European Union.

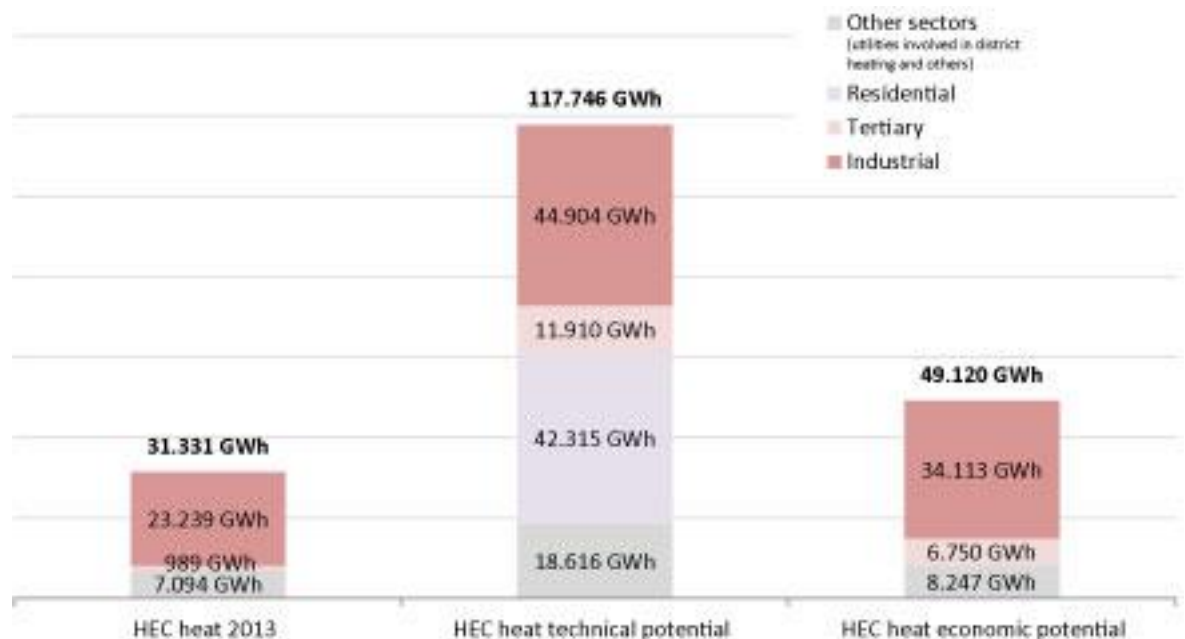
The agriculture sector has achieved the highest levels of energy intensity out of the three economic sectors, and has shown a certain degree of stability at a national level, while a gradual reduction has been observed at a European level (down 2.3% on average each year from 2005 to 2015 for the EU28).

ii. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling³⁴

According to the assessment of Italy's potential for the application of high-efficiency cogeneration (HEC) and efficient district heating and cooling, as required by Article 14 of the Energy Efficiency Directive (EED), the economic potential of HEC, based on current regulatory and market conditions, is equal to 49.1 TWh (4 224 ktoe) of useful heat. With respect to the total amount of useful heat produced via HEC in 2013 (the benchmark year for the assessment of potential increase carried out in accordance with the EED), which stood at 31.3 TWh (2 694 ktoe), the potential increase is estimated to be 17.8 TWh (1 529 ktoe). Of this increase in useful heat from HEC, 61% is linked to self-producing HEC power plants in the industrial sector (10.8 TWh), 32% from HEC power plants in the services sector (5.8 TWh), and 6% (1.2 TWh) from HEC power plants operated by energy utilities involved in district heating. The residential sector has no economic potential under the current market conditions and cost of the technologies.

A review of this potential is expected in the near future as part of the update under Directive 2012/27/EC (EED).

Figure 49 – Technical and economic potential of HEC in Italy – (GWh) [Source: GSE, assessment of Italy's potential for the application of HEC and efficient district heating and cooling. 2015-2016]

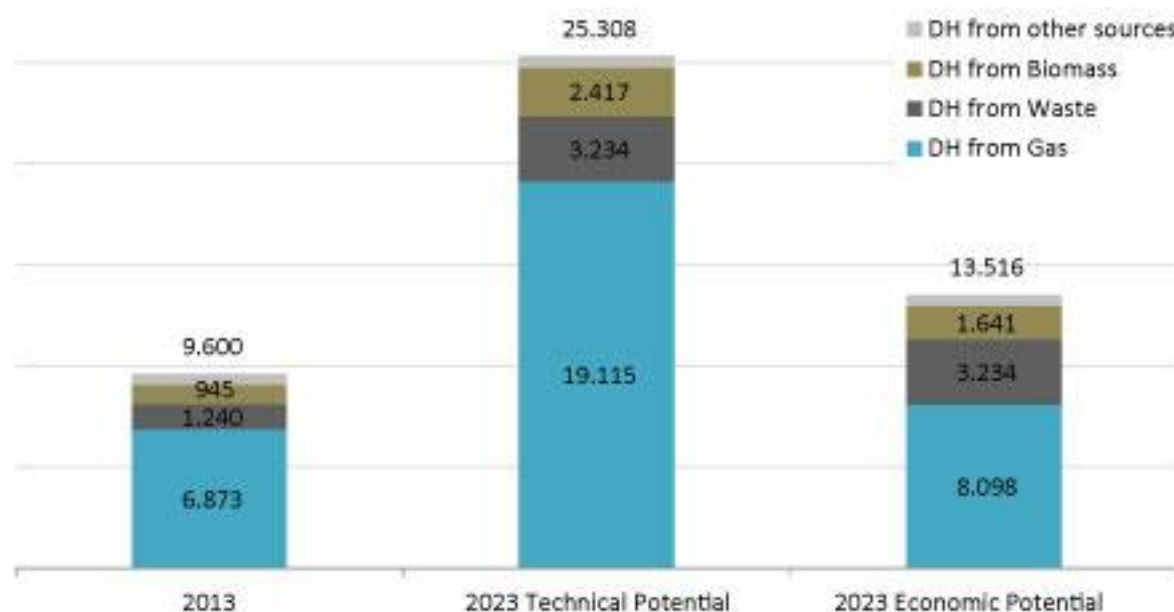


In the district heating sector, the economic potential was determined to be 13.5 TWh (1 160 ktoe). Compared with the heat supplied by district heating in 2013, which amounted to 825 ktoe, the potential increase through efficient district heating is estimated to be 335 ktoe. According to the assessment of potential increase carried out in accordance with the EED, further contributions to this increase in energy supplied by district heating could be made by heat production based on natural gas (1 225 GWh – i.e. 105 ktoe, of which 84 ktoe

³⁴ In accordance with Article 14(1) of Directive 2012/27/EU

from cogeneration), on biomass (696 GWh – 60 ktoe) and on waste-to-energy conversion (1 994 GWh – 171 ktoe).

Figure 50 – Technical and economic potential of district heating in Italy – (GWh) [Source: GSE, assessment of Italy's potential for the application of HEC and efficient district heating and cooling. 2015-2016]



iii. Projections considering existing energy efficiency policies, measures and programmes as described under point 1.2(ii) for primary and final energy consumption for each sector at least until 2040 (including for the year 2030)³⁵

The following table gives the projections for Gross Inland Consumption (GIC)³⁶ and primary and final energy consumptions during the 2020-2040 period, under current policies. The energy consumptions are broken down by sector and by source. The table also gives the projections for consumptions for non-energy uses.

The consumption projections show that, also under current policies, significant increases in energy efficiency will be achieved, highlighting a decoupling between the gross inland consumption (GIC) of primary energy and increases in GDP. The levels of energy consumption, which reached a peak in 2005, are characterised by a marked downturn that had already begun when the financial crisis hit. The drop in energy intensity (GIC/GDP) has continued, also thanks to the measures for promoting efficiency up to 2020: thereafter, this trend will no longer be guided by new policies or targets (apart from the ETS), but by market trends and inevitable technological improvements.

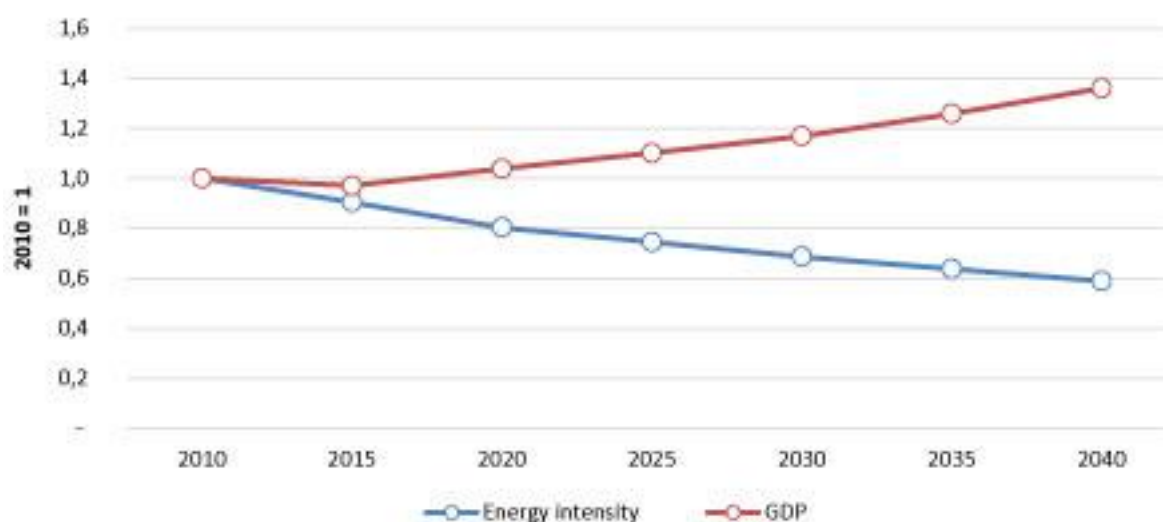
³⁵ This reference business as usual projection shall be the basis for the 2030 final and primary energy consumption target which is described in point 2.3 and conversion factors.

³⁶ Non-energy uses fall under Gross Inland Consumption.

Table 51 – Consumption of primary and final energy (for each sector) projected for 2020-2040 under the base scenario (ktoe) [Source: RSE]

Base scenario	2020	2025	2030	2040
Gross inland consumption	149,111	145,986	142,652	142,428
Solids	11,640	8,752	8,390	7,460
Petroleum products	50,711	48,045	46,001	41,606
Natural gas	55,838	56,890	55,829	56,416
Electricity	3,162	2,815	2,667	2,653
Renewables	27,760	29,484	29,765	34,294
Primary energy consumption*	142,441	139,103	135,702	134 718
Final energy consumption	116,393	115,064	113,182	114,571
sector-by-sector breakdown				
Industry	26,536	26,584	26,050	26,285
Residential	31,974	30,873	30,506	30,519
Tertiary	15,700	15,671	15,656	17,480
Transport	39,240	39,044	38,023	37,499
Agriculture	2,942	2,893	2,946	2,789
source-by-source breakdown				
Solids	2,013	2,271	2,191	1,834
Petroleum products	42,405	40,874	39,054	36,240
Natural gas	33,516	32,411	31,837	33,901
Electricity	25,209	25,805	25,996	28,097
Heat	4,127	4,007	4,136	4,554
Renewables	9,122	9,500	9,947	9,944
Final non-energy consumption	6,670	6,780	6,950	7,710

*Primary consumption does not include non-energy uses, which fall under Gross Inland Consumption.

 Figure 51 – Comparison between the projected energy intensity and GDP³⁷ in the 2010-2040 period


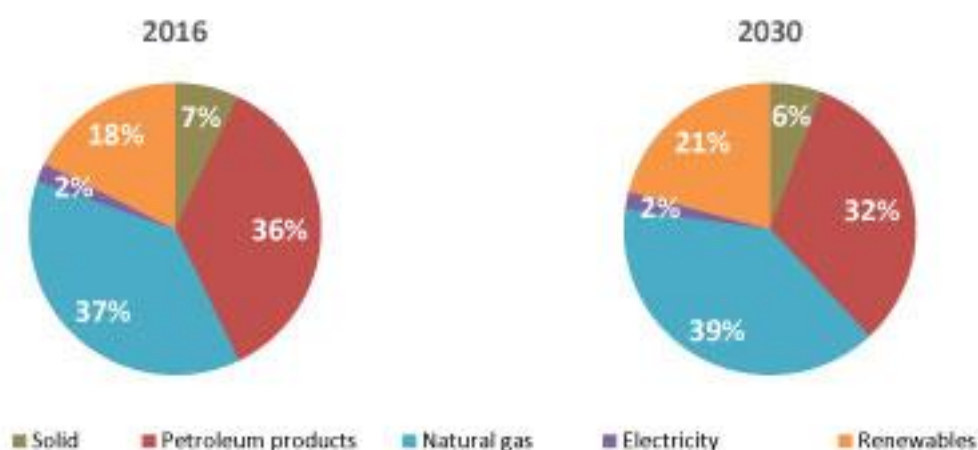
The changes in primary energy requirements have arisen through the combined effect of a variety of factors:

³⁷ 2010 chain-linked values

- the reduction in energy consumption in the final-use sectors, as a result of the energy-efficient processes that have been introduced and the inevitable replacement of obsolete devices;
- the different fuel mix in the final uses of energy, due to increased use of thermal renewable sources, electrification and biofuels;
- the indirect support lent to energy efficiency by the ETS, which also encourages greater penetration of RES into the ETS sectors during the entire projection period;
- the subsequent gradual process of decarbonising electricity generation, owing to increased production from renewable sources and the electrification of final uses.

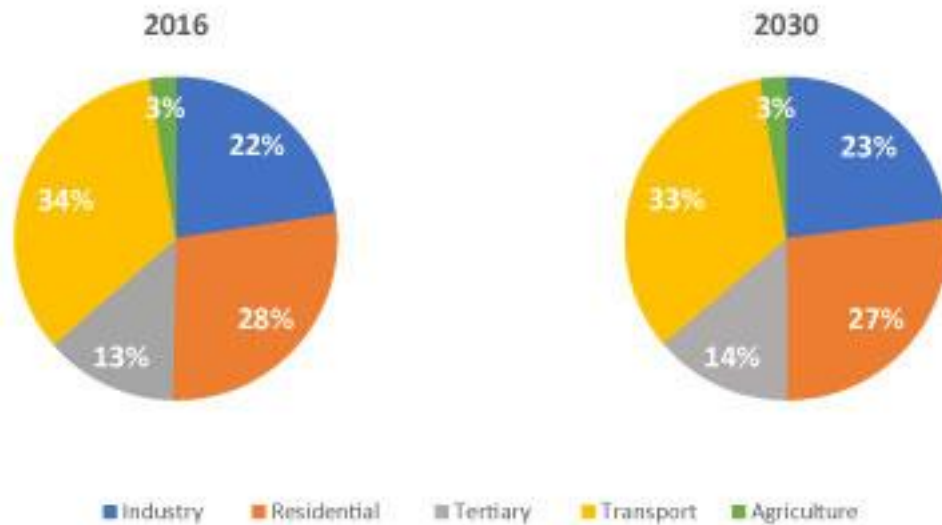
In terms of primary energy mix, natural gas will remain the main source in 2030. Conversely, the consumption of solid fuels and petroleum products will fall, with renewable sources being favoured instead. The year 2030 has been compared with the most recent year for which statistics are available, namely 2016, the values for which are given in the figure below.

Figure 52 – Comparison of the 2016 and 2030 primary energy mixes (base scenario)



At a sectoral level, conversely, the mix of final energy consumptions for 2030 is expected to remain practically the same as that of the most recent year for which statistics are available (2016).

Figure 53 – Comparison of the 2016 and 2030 final energy mixes (base scenario)



iv. Cost-optimal levels of minimum energy performance requirements resulting from national calculations, in accordance with Article 5 of Directive 2010/31/EU

The Energy Performance of Buildings Directive ('EPBD', Directive 2002/91/EC), and the recast EPBD (Directive 2010/31/EU) introduced the principles for improving the energy performance of buildings.

The recast EPBD required the Member States to define the minimum energy performance requirement for buildings on the basis of cost-optimal levels. To this end, the Directive introduced a method of comparative analysis for determining the reference requirements for national standards.

The Delegated Regulation (EU) No 244/2012 and the subsequent Commission Guidelines of 19 April 2012 set out a methodology framework for calculating the optimal energy requirements of buildings, from both a technical and an economic point of view.

The application in Italy of the method proposed by the Commission has made it possible to identify minimum energy performance requirements based on cost-optimal levels for new buildings and for existing buildings undergoing major or minor renovation of structures and installations.

The report entitled 'Methodology for calculating cost-optimal levels of minimum energy performance requirements (Article 5 of Directive 2010/31/EU)' sent to the Commission in August 2013 presented the results of these calculations and compared them with the requirements in force. Those assessments were then updated in 2018 by way of a new report that Italy submitted to the European Commission.

From analysing the results obtained, it is possible to make general observations that principally relate to building envelopes, technical installations and the costs of the optimal configurations.

The most extensive work on building envelopes (e.g. exterior insulation, replacing windows) is optimal only for new buildings and only in very few cases for existing ones, which were generally constructed between 1946 and 1976.

In the other cases, the high costs arising mainly from the civil engineering work associated with construction have led to other interventions (installations) being favoured, or only those on horizontal components.

The introduction of the scenario for not carrying out work on building envelopes (Level 1 for existing buildings) has also led to significantly less stringent transmittance values for existing

buildings, thus bringing down, in many cases, the total cost of the work, in relation to that concerning new buildings of the same type.

Table 52 – Comparison of transmittances

Intended use	Time of construction	Climatic zone	Uwall (W/m ² k)	Uroof (W/m ² k)	Ufloor (W/m ² k)	Uw (W/m ² k)
Residential	New	Milan (E)	0.27	0.18	0.17	27
		Palermo (B)	1.50	0.28	0.29	3.20
	Existing	Milan (E)	0.40	0.23	0.32	3.28
		Palermo (B)	0.80	0.31	0.49	3.95
Building for office use	New	Milan (E)	0.36	0.30	0.30	1.10
		Palermo (B)	1.50	0.46	0.56	5.00
	Existing	Milan (E)	0.17	0.32	0.29	2.90
		Palermo (B)	1.04	1.03	0.30	4.45
Building for school use	Existing	Milan (E)	0.80	0.20	0.29	3.70
		Palermo (B)	0.35	0.26	0.42	3.80

The integral use of heat pumps for air conditioning (heating and cooling) and ACS (full electric building) is the optimal result only for newly constructed buildings of single-family residence and office type. In the other cases, the selected installation solution is always based on the integration of heat pumps, gas boilers (three-star condensing) and multi-split systems.

The installation of solar panels, which always features amongst the work identified for all types of buildings (these panels having an installed power of between 20 and 26 W/m²), has made it possible to achieve coverage levels of 50% to 70% for newly constructed residential buildings, and of 10% to 30% for existing ones. The coverage level for offices is not so high, amounting to between 40% and 50% for new buildings and between 15% and 20% for existing ones.

It is important to underline that, in order to fit solar panels on the various reference buildings in question, it has always been assumed that optimal levels of space and orientation will be available, with no consideration being given to any possible constraints or obstructions that are often actually present.

School buildings, which have a significantly different use profile compared with the other types, are the only types of building for which no provision has been made for the use of heat pumps, owing to the absence of any summer air-conditioning system. The heating and ACS system is in fact fully integrated within the single condensing boiler. For this type of building, the coverage of renewables, via solar power, is lower (around 20% of the total) and relates to around half of the energy requirements for lighting.

The costs associated with the optimal solutions identified vary greatly between new buildings and existing buildings, but the differences arising from the different climatic area in question are not as substantial.

The following table provides a summary of the costs and the average primary energy for each type of building and time of construction (new and existing).

Table 53 – Comparison of costs

Intended purpose	Time of construction	Climatic area	Costs (€/m ²)	EP kWh/
Residential	New	Milan (E)	452	92
		Palermo (B)	386	102
	Existing	Milan (E)	555	100
		Palermo (B)	443	78
Building for office use	New	Milan (E)	514	90
		Palermo (B)	468	112
	Existing	Milan (E)	418	107
		Palermo (B)	383	107
Building for school use	Existing	Milan (E)	330	115
		Palermo (B)	190	56

3.9 Dimension energy security

i. Current energy mix, domestic energy resources, import dependency, including relevant risks

In 2016, national production of energy sources fell by a total of 6.5% compared with 2015, from 36.1 to 33.8 Mtoe (Eurostat data). Separating the production data according to source shows that there has been a zeroing of generation of solids, a reduction of 30% from petroleum sources and a 15% fall in natural gas compared with growth in renewables of 1.2%. A slight increase can be seen in overall net energy imports between 2015 and 2016; in particular, imports of natural gas are increasing (+6.6%), while a reduction can be seen in imports of solid fuels (-13%), electricity (-20%) and petroleum products (-1%).

Table 54 – Domestic energy resources, historical data 2015-2016 (ktoe)

	2015	2016
Domestic production	36,134	33,797
Solids	51	-
Crude oil	5,824	4,056
Natural gas	5,545	4,738
Renewables*	24,713	25,004

* Includes share of non-renewable waste

Table 55 – Net imports, historical data 2015-2016 (ktoe)

	2015	2016
Net-Imports	119,138	121,707
Solids	12,324	10,712
Crude oil and petroleum products	52,831	52,316
Natural gas	49,996	53,294
Electricity	3,988	3,184
Renewables*	2 702	2 200

* Includes share of non-renewable waste

The indicator of the country's degree of dependence on imports of commodities from abroad has increased slightly (from 77.1% in 2015 to 77.7%³⁸ in 2016), but is still below the above 80% values that have been recorded in the past. In recent years, the increasing percentage of RES and the reduction in energy intensity have contributed to a reduction in our country's dependence on foreign supply sources: in 2016, for example, despite still being high, the national energy requirements met by net imports was around 5 percentage points lower than in 2010.

³⁸ It is to be noted that energy dependency is calculated as the ratio between net imports and the sum of gross inland consumption and marine bunkerage..

ii. Projections for development with current policies and measures at least until 2040 (including for the year 2030)

The tables below show the projections for production of domestic energy resources and dependence on imports in the period 2020-2040 with the current policies. As is evident, energy dependency decreases significantly, from the current 77.7% to 75.4% in 2030 and 74.6% in 2040.

Table 56 – Domestic energy resources, projections 2020-2040 base scenario (ktoe)

	2020	2025	2030	2040
Domestic production	37,615	38,409	33 714	36,549
Solids	50	-	-	-
Crude oil	7,005	6,365	4,589	2,440
Natural gas	4,750	4,340	2,445	1,010
Renewables*	25,810	27,704	26,680	33,099

* Includes share of non-renewable waste

Table 57 – Net imports, projections 2020-2040 base scenario (ktoe)

	2020	2025	2030	2040
Domestic production	113,816	109,993	109,443	108,355
Solids	11,590	8,753	8,390	7,460
Crude oil and petroleum products	46,026	44,100	43,912	41,946
Natural gas	51,088	52,550	53 384	55 406
Electricity	3,162	2,810	2,667	2,653
Renewables*	1,950	1,780	1,090	890

* Includes share of non-renewable waste

Table 58 – Energy dependency, projections 2020-2040 base scenario

	2020	2025	2030	2040
Energy dependency	75.2%	74.2%	75.4%	74.6%

3.10 Dimension internal energy market

3.10.1 Electrical interconnectivity

i. Current interconnection level and main interconnectors³⁹

Interconnection capacity is currently primarily located at the country's northern border (4 lines with France, 12 with Switzerland, 2 with Austria, 2 with Slovenia). In total, there are 7 circuits at 380 kV, 9 circuits at 220 kV and 3 circuits at 150/132 kV on the northern border. There is also a direct current connection with Greece and one that connects Sardinia and the peninsula with Corsica (SACOI2). Sardinia is also connected to Corsica by an alternating current cable. A 220 kV double circuit cable connects Sicily with Malta.

Figure 54 – Map of the existing interconnections [Source: Terna – Development Plan 2018]



Francia	France
Svizzera	Switzerland
Austria	Austria
Slovenia	Slovenia
Grecia	Greece
Malta	Malta

The total value of exchange capacity at the northern border for the year 2017 is between 6 300 MW and 8 435 MW in imports and between 3 010 MW and 3 895 MW in exports.

³⁹ With reference to overviews of existing transmission infrastructure of Transmission System Operators (TSOs)

Table 59 – Capacity of the interconnection lines overseas

Italian station	Foreign	Volta
Camporosso	Trinité Victor	220
Venaus	Villarodin (FR)	380
Rondissone	Albertville	380
Rondissone	Albertville	380
Pallanzeno	Serra (CH)	220
Ponte	provenance	220
Valpelline	Riddes (CH)	220
Avise	Riddes (CH)	220
Bulciago	Soazza (CH)	380
Musignano	Lavorgo (CH)	380
Cagno (*)	Mendrisio	380
Mese	Gorduno (CH)	220
Gorlago	Robbia (CH)	380
S. Fiorano	Robbia (CH)	380
Tirano (*)	Campocologn	150
Villa di Tirano	Campocologn	132
Soverzene	Lienz (AT)	220
Tarvisio (*)	Greuth (AT)	132
Redipuglia	Divaccia (SI)	380
Padriciano	Divaccia (SI)	220
Galatina	Arachthos	400
Codrongianos/S	Lucciana	200
S. Teresa di	Bonifacio	150
Ragusa	Maghtab	220

(*) Merchant Line

Table 60 – Interconnection capacity [data provided by Terna]

Period	Border	Winter [MW]		Summer [MW]	
		Peak	Off Peak	Peak	Off Peak
Imports					
Monday – Saturday	France	3,150	2,995	2,700	2,470
	Switzerland	4,240	3,710	3,420	3,100
	Austria	315	295	270	255
	Slovenia	730	620	515	475
	Total at the northern border	8,435	7,620	6,905	6,300
	Greece	500	500	500	500
Sunday	France	2,995	2,995	2,470	2,470
	Switzerland	3,710	3,710	3,100	3,100
	Austria	295	295	255	255
	Slovenia	620	620	475	475
	Total at the northern border	7,620	7,620	6,300	6,300
	Greece	500	500	500	500
Malta	200	200	200	200	
Exports					
Monday – Saturday	France	995	1,160	870	1,055
	Switzerland	1,810	1,910	1,440	1,660
	Austria	100	145	80	100
	Slovenia	660	680	620	645
	Total at the northern border	3,565	3,895	3,010	3,460
	Greece	500	500	500	500
Sunday	France	1,160	1,160	1,055	1,055
	Switzerland	1,910	1,910	1,660	1,660
	Austria	145	145	100	100
	Slovenia	680	680	654	645
	Total at the northern border	3,895	3,895	3,460	3,460
	Greece	500	500	500	500
Malta	200	200	200	200	

ii. Projections of interconnector expansion requirements (including for the year 2030)⁴⁰

The interconnection projects currently underway are the Italy-France and Italy-Montenegro (first centre) connections, which will be up and running by 2020 and will contribute to the achievement of the target of 10% by 2020.

⁴⁰ With reference to national network development plans and TSOs' regional investment plans

In addition to a new project with Austria, which is at an advanced stage of the authorisation process, the complete overhaul of the Sardinia-Corsica-Mainland Italy connection to replace SACOI 2 and the underwater link between Italy and Tunisia are at the design stage.

Figure 55- Interconnection projects planned by Terna [Source: Terna – Development Plan 2018]



Francia	France
Austria	Austria
Montenegro	Montenegro
Tunisia	Tunisia

Furthermore, the interconnectors (pursuant to Law 99/2009) with Switzerland, Slovenia and Austria, which are at the authorisation stage, should also be taken into account. These are complemented by the merchant lines at the initiative of private parties (Reg. 14/2009), which must be taken into account by Terna so as to avoid overestimating the interconnections and overburdening the country. Compared with the number of authorisations granted, however, few merchant lines have been put in place; this therefore represents an uncertainty factor. Among these, therefore, are connections that would open up new borders (with Croatia and with Albania) or that would push the connection with Tunisia further north, towards Lazio. The list below shows the development projects for the overseas interconnection; these were identified by Terna in the Development Plan 2017.

At the design stage:

- HVDC connection between Italy and France (Piosasco – Grand’Ile): high-voltage direct current (HVDC) terrestrial cable, of nominal power 2x600 MW, between the two electrical stations in Piosasco (Piemonte) and Grand’Ile (Savoia);
- HVDC connection between Italy and Montenegro (Villanova – Tivat): two pole lines at ± 500 kVcc partly in terrestrial cable and partly in marine cable, with transmission capacity of 2X600 MW, between the two Converter Stations in Cepagatti (Abruzzo) and Kotor (Montenegro);
- 132 kV connection between Prati di Vizzi/Brennero (IT) and Steinach (AT), in conjunction with the local Distributor.

At the design stage:

- 400 kV power line Interconnection between Italy and Austria, in two stages: i) removal of the restrictions on the current 220 kV connection between Italy and Austria; ii) new 400 kV connection;
- connection between Italy and France, SACOI 3 ‘Sardinia-Corsica-Mainland Italy’: replacement of the existing SACOI 2, which has now reached the end of its useful life;
- connection between Italy and Tunisia; work of strategic importance for the electrical transmission system in the Mediterranean basin, which will provide an additional tool to optimise the use of energy resources between Europe and north Africa.

Pursuant to Law 99/2009:

- HVDC interconnection between Piosasco and Grand’Ile (in conjunction with the public connection cited above);
- HVDC interconnection between Italy and Montenegro (share of capacity of the public connection cited above);
- 400 kV interconnection between Airolo (CH) and Pallanzeno (IT) (connected with the HVDC Pallanzeno-Baggio project);
- 220 kV interconnection between Nauders (AT) and Glorenza (IT);
- HVDC interconnection between Salgareda (IT) and Divaca/Bericevo (SI).

Figure 56 – Interconnection projects pursuant to Law 99/2009 planned and developed by Terna [Source: Terna – Development Plan 2018]



Francia	France
Svizzera	Switzerland
Austria	Austria
Slovenia	Slovenia
Montenegro	Montenegro

3.10.2 Energy transmission infrastructure

i. Key characteristics of the existing transmission infrastructure for electricity

As at 30 June 2017, the national transmission grid has a network density of over 66,000 km of lines and cables and 861 stations (source: Development Plan 2018). The network has a mainly longitudinal spread. The zone-based structure, the corresponding transit restrictions and details of the connection lines between zones are shown in the figure below.

The main difficulties associated with the risks of network overload are to be found in the north-west, along the lines that transmit the imported energy from Switzerland and France and the production of hydroelectric power to the consumer centres in Liguria and Lombardy (Milan).

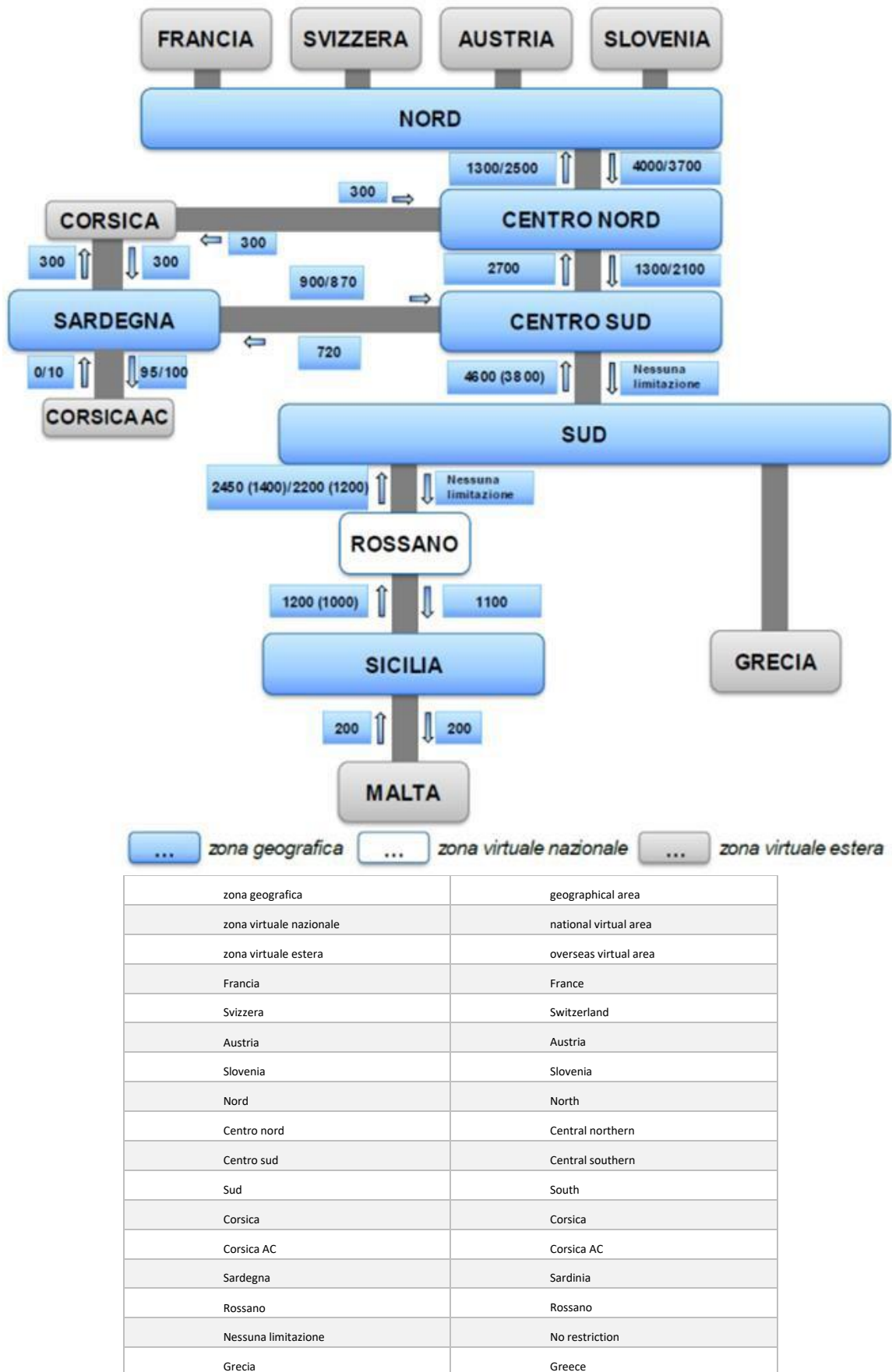
High overloads occur in the north-east, although the commissioning of the new power line between Udine west and Redipuglia should lead to a significant reduction in transmission restrictions.

The central part of the country is characterised by structural weaknesses predominantly on the Adriatic coast, which is in constant use for transmission between southern and central Italy. Journeys have increased in recent years as a result of the commissioning, in the south, of new, more efficient production capacity from conventional and renewable sources, which are destined to increase in view of new generation from renewable sources.

The concentration of production from renewable sources in the areas of Avellino, Foggia and Benevento and from traditional sources in Apulia and Calabria show high numbers of journeys in the direction south – central southern predominantly on the Adriatic coast and along the high-voltage lines that branch northwards from Calabria.

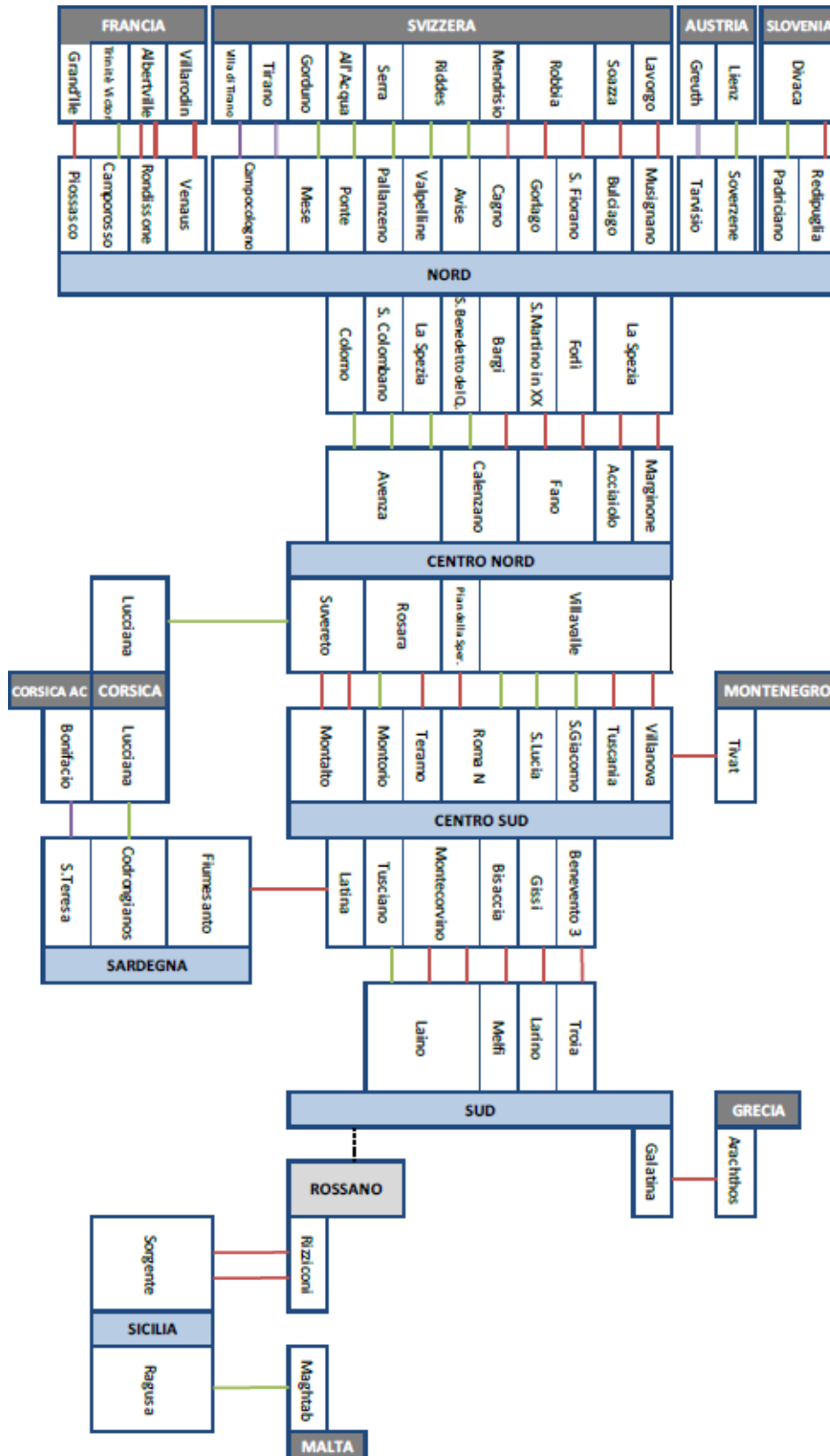
Other critical areas are Sardinia, due to the transmission difficulties discovered on the 150 kV network in the north-eastern area of the island (Gallura) and due to a lack of plants suitable for providing flexibility services, and Sicily, which has reduced potential in terms of transport capacity between the east and west areas of the island and difficulties in making the best use of the three underwater connections with Calabria.

Figure 57: Limit values for transit between the market areas, winter scenario [TERNA, Limit values for transit between the market areas, issue 24, December 2018]



Sicilia	Sicily
Malta	Malta

Figure 58: Overview of the connection lines between areas [TERNA, Identification of areas of the relevant network, Annex A.24 to the network code, issue 10, December 2018]



Francia	France
Malta	Malta
Grecia	Greece
Svizzera	Switzerland
Austria	Austria

Slovenia	Slovenia
Grand'île	Grand'île
Nord	North
Centro nord	Central northern
Centro sud	Central southern
Sud	South
Rossano	Rossano
Sicilia	Sicily
Sardegna	Sardinia
Corsica	Corsica
Montenegro	Montenegro
Albertville	Albertville
Villanodin	Villanodin
Villa di Tirano	Villa di Tirano
Tirano	Tirano
Soverzene	Soverzene
Gorduno	Gorduno
All' Acqua	All' Acqua
Serra	Serra
Riddes	Riddes
Mendris io	Mendris io
Robbia	Robbia
Soazza	Soazza
Lavorgo	Lavorgo
Greuth	Greuth
Lienz	Lienz
Divaca	Divaca
Piossasco	Piossasco
Camporosso	Camporosso
Rondissone	Rondissone
Venaus	Venaus
Mese	Mese
Ponte	Ponte
Pallanzeno	Pallanzeno
Valpelline	Valpelline
Avise	Avise
Cagno	Cagno
Gorlago	Gorlago
S. Fiorano	S. Fiorano
Bulciago	Bulciago
Musignano	Musignano
Tarvisio	Tarvisio
Padriciano	Padriciano
Redipuglia	Redipuglia
Colomo	Colomo
S. Colombano	S. Colombano
La Spezia	La Spezia
Bargi	Bargi
S. Martino in XX	S. Martino in XX
Forti	Forti

S. Benedetto de IQ	S. Benedetto de IQ
Avenza	Avenza
Calenzano	Calenzano
Fano	Fano
Acciaiole	Acciaiole
Marginone	Marginone
Lucciana	Lucciana
Corsica AC	Corsica AC
Bonifacio	Bonifacio
S. Teresa	S. Teresa
Codrongianos	Codrongianos
Fiumesanto	Fiumesanto
Survento	Survento
Rosara	Rosara
Villavalle	Villavalle
Montalto	Montalto
Montonio	Montonio
Teramo	Teramo
Roma N	Roma N
S. Lucia	S. Lucia
S. Giacomo	S. Giacomo
Tuscania	Tuscania
Villanova	Villanova
Tivat	Tivat
Latina	Latina
Tusciano	Tusciano
Montecorvino	Montecorvino
Bisaccia	Bisaccia
Gissi	Gissi
Benevento 3	Benevento 3
Laino	Laino
Melti	Melti
Larino	Larino
Troia	Troia
Sorgente	Sorgente
Ragusa	Ragusa
Rizzioni	Rizzioni
Maghtab	Maghtab
Galatina	Galatina
Arachthos	Arachthos

As regards the electricity distribution network, in December 2016 there was 391,000 km of medium-voltage network (MV) and 865,000 km of low-voltage (LV) network, operated by 154 distributors, to supply more than 29 million domestic users and 7.4 million non-domestic users, with total distribution of 264,000 GWh (source ARERA [Italian Regulatory Authority for Energy, Networks and Environment] – Annual survey of the regulated areas).

In the same year, 743,000 plants were connected to the distribution networks, including 731,000 FV, with a total of 30.6 GW and gross production of 62.9 TWh, including 78.2% RES,

and an average self-consumption share of 22.4% (source ARERA [Italian Regulatory Authority for Energy, Networks and Environment]).

As regards the natural gas transport network, in Italy in 2017 9,600 km of national network and 22,900 km of regional network was in operation. Natural gas distribution takes place by means of 261,000 km of network, 57.5% at low pressure, 41.8% at medium pressure and 0.67% at high pressure, 21% of which is owned by the municipalities. The number of customers served amounted to around 21.7 million domestic users, 219,000 landlords, 97,000 for public service activities and, finally, 1.5 million for other uses, with total consumption standing at 31.8 billion m³. Total net consumption, including thermoelectric generation, was 75.2 billion m³ (source ARERA – Annual survey of the regulated areas).

ii. Projections of network expansion requirements at least until 2040 (including for the year 2030)⁴¹

Terna's Development Plan 2017 identifies a number of development actions that qualify as priority actions, including two overseas connections (HVDC Grand'Ile-Piosasco and Italy-Montenegro). The domestic connections are identified on the basis of the following primary requirements:

- reduction in congestion between market areas;
- reduction in congestion between areas and restrictions on production capacity;
- increase in safety and reliability in metropolitan areas;
- increase in quality and safety.

Details of the actions are set out below, grouped by explanation.

Reduction in congestion between market areas

- 400kV 'Calenzano – Colunga' power line to increase the exchange limits on the North – Central Northern section;
- 400 kV 'Foggia – Villanova' and 'Deliceto – Bisaccia' power lines to increase the exchange limits in the South – Central Southern direction and to encourage production in the plants of renewable sources to the South;
- 400 kV 'Montecorvino – Avellino – Benevento' power lines to increase the exchange limits in the South- Central-Southern direction and to reduce the constraints on the Rossano production centre, as well as encourage the production of plants from renewable sources in the South;
- redevelopment of North Calabria network, which contributes, together with the Traversale Calabria (400 kV Feroleto-Maida power line), which was completed in December 2013, to reduce the constraints on the Rossano production centre and on production from renewable sources in Calabria;

Reduction in congestion between areas and restrictions on production capacity

- 400 kV power line between Milan and Brescia to reduce congestion on the section between the north-west and the north-east areas of the country;

⁴¹ With reference to national network development plans and regional investment plans of TSOs

- 400 kV 'Udine – Redipuglia' power line to reduce constraints on the section of the network downstream of the Redipuglia junction, which currently limits exchanges with the Slovenian border and affects the use of locally produced resources;
- streamlining of the Valle del Piave medium network in order to reduce congestion and encourage production from renewable sources;
- 400 kV 'Paternò – Pantano – Priolo' and 'Chiaramonte Gulfi – Ciminna' power lines for greater interchangeability of resources in Sicily and between Sicily and the continent, also to increase reliable operation and encourage production from renewable sources;
- 150 kV SE S.Teresa – Buddusò power line to reduce congestion and improve the safety and quality of the electricity transmission service.

Increase in safety and reliability in metropolitan areas

- streamlining of AAT and AT Turin, Milan, Genoa, Florence, Rome, Naples and Palermo networks to reduce congestion that impacts upon the operating safety and reliability of the primary networks that supply areas with a high concentration of users

Increase in quality and safety

- 132 kV 'Elba-Continente' power line and 150 kV interconnection of the Campania islands, to ensure adequate levels of safety, continuity and efficiency of the local service;
- redevelopment of the 150 kV network in the Sorrento Peninsula, for quality and continuity of supply service for the local AT network, which features high load density

Table 61 – Exchange values according to ENTSO-E's Ten-Year Network Development Plan (TYNDP) 2018

	ENTSO-E	Transfer capacity		Transfer capacity		
		=>	<=	=>	<=	
Inter-National	FR-ITn	4350	2160	4350	2160	
	CH-ITn	4 240	1 91	6000	3700	
	AT-ITn	405	235	1050	850	
	ITn-SI	680	730	1640	1895	
	ITcs-ME	600	600	1 200	1 200	
	GR-ITs	500	500	500	500	
	ITsic-MT	200	200	200	200	
	ITsic-TN	0	0	600	600	
	Corsica	FRC-ITCO	50	150	150	200
		ITcn-ITCO	300	300	400	400
ITsar-ITCO		350	300	500	450	
Intra-National	ITcn-ITcs	1 400	2 60	1 750	3 200	
	ITcn-ITn	1 550	3 75	2 100	4 100	
	ITcs-ITs	9 999	4 50	9 999	5 700	
	ITcs-ITsar	700	900	700	900	
	ITsic-ITsar	0	0	0	0	
	ITs-ITsic	1 100	1 20	1 100	1 200	

3.10.3 Electricity and gas markets, energy prices

i. Current situation of electricity and gas markets, including energy prices

Current situation of electricity markets

Wholesale markets

In Italy, GME (the energy market operator) is the entity which, pursuant to Legislative Decree No 79/1999, has the task of organising and managing the energy markets, broken down into the spot energy market – in turn divided into the day-ahead market and the intraday market – and the forward electricity market with physical energy delivery obligation. GME is also the entity identified as the Nominated Electricity Market Operator (NEMO) pursuant to Commission Regulation 2015/1222 (known as the CACM Regulation).

GME is also involved – together with ARERA, Terna and the Ministry of Economic Development – in the WB6 (Western Balkan 6) project aimed at promoting the launch of regional coupling in the Balkan area on the basis of the experience gained in Italy in the organisation and management of national markets and the integrated electricity market.

The objective of the day-ahead market is to trade energy for the 24 hours of the delivery day. It is managed through hourly auctions at clearing price (system marginal price) and bids can be made starting from the ninth day before the day of delivery. The day-ahead market is a zonal market – the territory is divided into zones representing portions of the transmission grid with limited exchange capacity between them. If flows exceed the maximum transit limit allowed by cross-zonal interconnections, the price is recalculated in each zone as if each was a separate market from the others (market splitting). While bids for sale are valued in each hour at the relevant zonal price, bids to buy are valued in each hour at a National Single Price (PUN) of purchase. This is calculated as the average of the zonal prices weighted by the value of zonal purchases, net of pumping and foreign purchases. In this market, GME acts as a central counterparty for operators.

In February 2015, Multi Regional Coupling (MRC) was launched on the northern border with France, Austria and Slovenia, anticipating the implementation of the provisions of Commission Regulation (EU) 2015/1222 of 24 July 2015.

Like the day-ahead market, the intra-day market is a zonal market. Since January 2011, this market has been divided into several sessions (discrete²⁰) with progressive closing times. The intraday market consists of seven sessions (MI1, MI2, MI3, MI4, MI5, MI6, MI7), structured as an auction with clearing price where, unlike in the day-ahead market, both bids for sale and bids to buy are valued at the zonal price. GME acts as a central counterparty for operators in this market too. Since June 2016, MI2 and MI6 sessions have been managed in coordination with the two corresponding intraday market sessions for Slovenia, within the intraday market coupling project. This has increased the efficiency of the allocation of cross-border capacity on the Slovenian border, through the shift from explicit allocation auctions to implicit allocation within these intraday market sessions managed by GME.

The Dispatching Services Market (MSD) is the platform through which Terna supplies the

resources necessary for the safe management of the system by resolving intra-zonal congestion, creating reserve capacity and performing real-time balancing. Unlike other markets, it is Terna, as part of a centralised dispatching model, which in this case acts as the central counterparty of the authorised operators. The MSD is divided into a programming phase (ex-ante MSD) and the balancing market (ex-post MSD or MB). The ex-ante MSD and the balancing market take place in several sessions, as provided for in the dispatching rules. The ex-ante MSD, in particular, into six programming sub-phases (MSD1, MSD2, MSD3, MSD4, MSD5, MSD6) which take place concurrently with the intraday sessions following the publication of the results in the day-ahead market (12:55 on the day before delivery). The balancing market is organised in six sessions in which Terna selects bids referring to groups of hours on the same day in which session 24 takes place. Operators submit their bids – which Terna can accept throughout the ex-ante MSD and in the first balancing market session – in MSD1 and can subsequently modify them starting from the second balancing market session. Trading in the ancillary services market takes the form of a discriminatory auction, where each accepted bid is valued at its offer price (pay as bid).

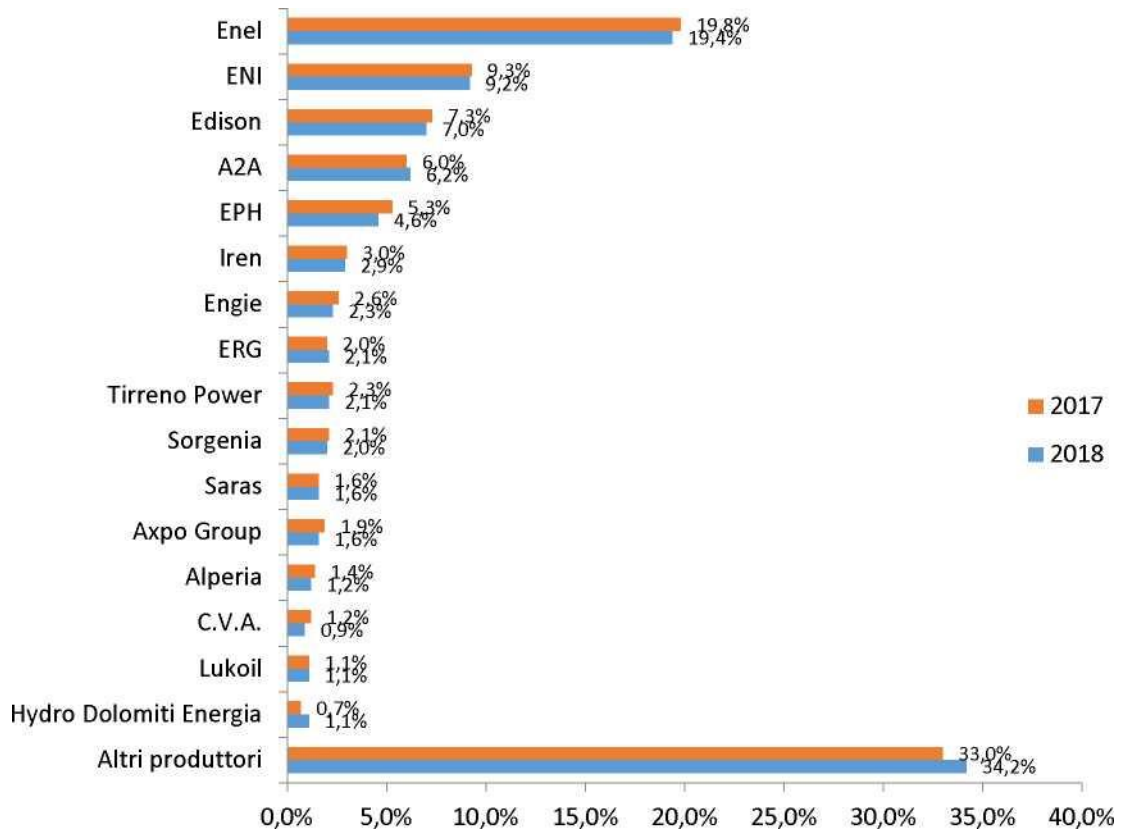
The forward electricity market is where forward contracts with an obligation to deliver and withdraw energy are traded. Trades are conducted on a continuous basis and concern two types of contracts, baseload and peakload. These can be traded for monthly (three products listed at the same time), quarterly (four products listed at the same time) and annual (one product) delivery periods.

Operators can sell and buy energy not only through GME's organised market, but also by entering into purchase and sale contracts concluded outside the bidding system. These contracts are in any case registered on a specific platform, the Energy Account Platform (PCE), which gives operators ample flexibility in optimising their portfolio of contracts, including bilateral contracts concluded on brokerage platforms.

Some summary quantitative data on generation and wholesale markets (year 2018 – Source: ARERA Annual Report and GME Annual Report).

With a gross production of 290.6 TWh, the contribution of the main producers is shown in the figure below.

Figure 59: Contribution of major groups to gross inland production: comparison 2017-2018
 [Source: ARERA]



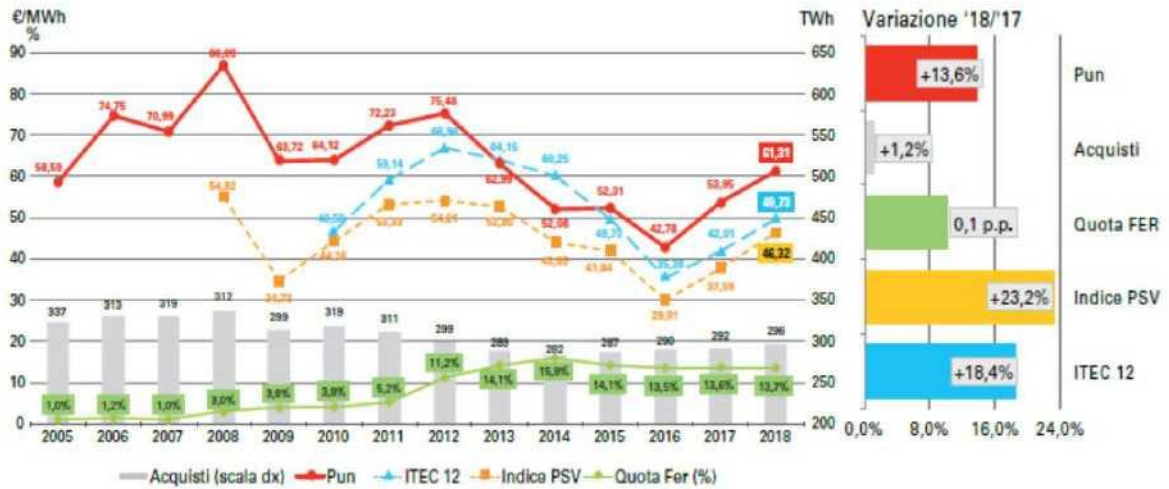
Altri produttori	Other producers
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The Herfindahal-Hirschman Index (HHI) on gross generation was 610, down from the 2017 figure of 638.

The positive trend of recent years continued in terms of volumes traded directly on the exchange (213 TWh, +1.0%), the highest value in terms of liquidity recorded since 2010 and accounting for 72% of total trading on the day-ahead market (295.6 TWh). 269 operators are registered on the electricity trading platforms operated by GME. Volumes traded on the forward energy market remain modest (1.2 TWh).

As regards the average purchase price of electricity, 2018 saw a significant recovery (€61.31/MWh) with respect to 2017 (about €53/MWh). The following figure shows the trend of the PUN over time in relation to the main determinants. Provisional data for 2019, on the other hand, show a marked decline to almost 2017 levels.

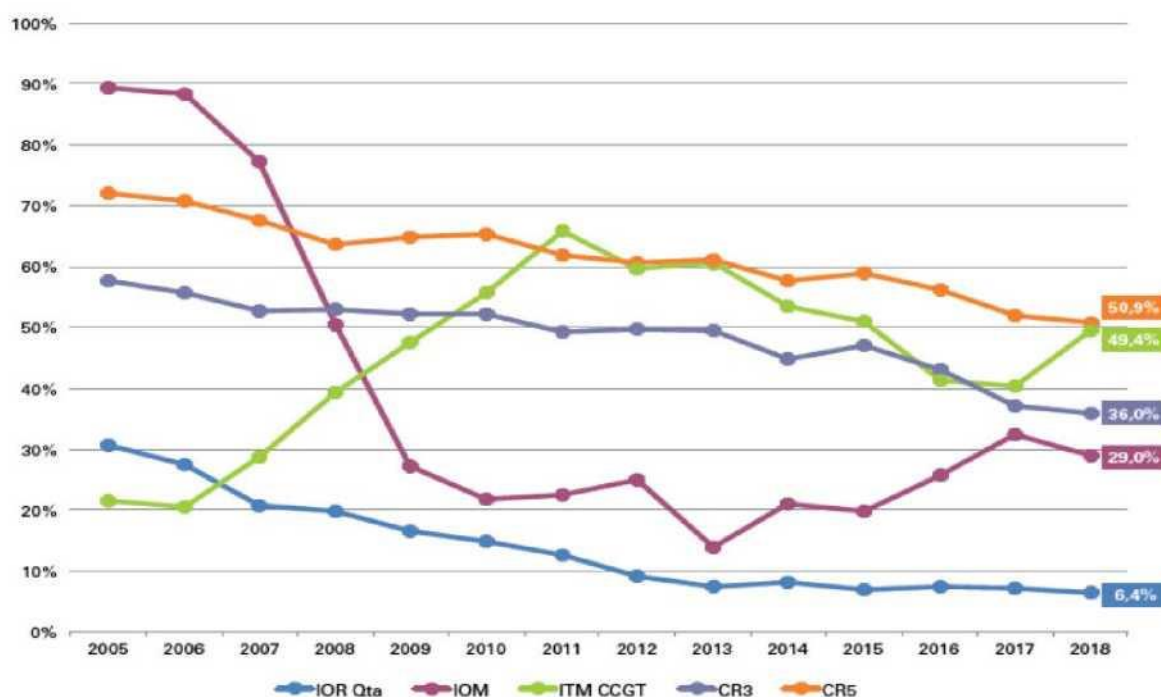
Figure 60: Trend in PUN and its determinants [Source: GME]



<i>Acquisti (scala dx)</i>	<i>Purchases (scale on right)</i>
<i>Pun</i>	<i>National Single Price</i>
<i>ITEC 12</i>	<i>ITEC 12</i>
<i>Indice PSV</i>	<i>Virtual Trading Point index</i>
<i>Quota Fer (%)</i>	<i>RES (%)</i>
<i>Variazione '18/'17</i>	<i>2017-2018 variation</i>

The increased availability of renewable generating capacity and imports (48.1 TWh, or 9.1% more than in the previous year) also had an impact on market concentration, which generally further improved. This can be seen from the decrease in the market share of the leading operators (CR3 and CR5), as shown in the figure below.

Figure 61: Competitiveness indicators at aggregate level [Source: GME]



Retail market

For data on the retail market, please refer to the data contained in the ARERA report, via the following link <https://www.arera.it/it/docs/18/596-18.htm>.

Despite the improvement and the measures taken in recent years, there is still a gap between Italy and the other European countries in terms of the price of gas and electricity; this impacts directly on the competitiveness of companies and the purchasing power of households, particularly those living in energy poverty.

As a result of the problems that have emerged in relation to the liquidity of the marginal sources of supply of the system, for gas there is still a substantial gap in costs on the wholesale markets between VTP and TTF (Dutch trading platform); in 2017, this gap was equivalent to €2/MWh, although it has now returned to around €4/MWh, and this is reflected in final prices.

There is a general price gap in electricity compared with the European average and in particular compared with France. The reasons for this difference are:

- price of gas (marginal source for Italy) still higher in main European hubs;
- energy mix moved heavily towards gas combined cycle plants which, despite being more efficient, have more variable costs compared with coal-fired and nuclear plants, which are still present in significant numbers in the European energy mixes;
- growth in costs for the network services;
- high systems charges, due mainly to incentives for renewables and subsidies, which have seen strong growth in the last year, connected with the promotion of energy

efficiency.

ii. Projections of development with current policies and measures at least until 2040 (including for the year 2030)

Realistically, it will only be possible to phase out coal and integrate renewable sources by taking account of the need for strengthening works both on the transmission and distribution networks, in as integrated and coordinated a manner as possible.

As regards the national transmission grid, the Development plan submitted by Terna in 2018, which was drawn up based on the SEN objectives, already identifies the priority actions to achieve the objectives.

In particular, the increase in production from renewable sources, the frequency of which is higher in the southern regions, causing an increase in power flows from the south to the north, requires strengthening works on this section; this work must, however, be accompanied by strengthening work on the intermediate sections (south-central south and central north-north).

Among the new actions, which are already set out in Terna's Development plan, is therefore the so-called Adriatic ridge, an HVDC cable between the sections of the central south and central north markets, connected to the electrical junctions of Villanova (or Villavalle) and Fano (or Porto Tolle).

The decarbonisation target is causing issues for the safety management of the Sardinian network. The option of a new connection with Sardinia (southern part) must therefore be evaluated. A first hypothesis proposed by the manager of the network is that of two new connections 'Mainland-Sicily' – 'Sicily-Sardinia'; both the Ministry of Economic Development and ARERA intend to carry out their own assessments.

One subject to consider is that of the coordinated development of infrastructure, for example the infrastructure between the transport of energy and rail and road transport, in order to promote multiple uses of the same infrastructure, with little impact on the country.

From this perspective, the integration of the RFI electricity network purchased by Terna will enable some of the actions already set out in the previous plans to be reviewed in the future, allowing system safety targets to be met along with the interconnection requirements with renewables.

4.6 Dimension research, innovation and competitiveness

i. Current situation of the low-carbon-technologies sector and, to the extent possible, its position on the global market (that analysis is to be carried out at a European Union or global level)

Despite the presence of excellence, Italy is still performing badly when it comes to R&D in the energy sector, as a result of the relatively low priority level attributed to research, the fragmentation of the stakeholders and the lack of coordination; this generates a technological dependence from overseas and a growing commercial deficit in high-technology products.

In recent years, there has been a strong focus on more extensive use of alternative sources, partly driven by environmental obligations that have provided impetus for new technological demand. The positive results recorded in recent decades in the field of thermo-electromechanics do not currently appear to be capable of overcoming the limits of a weak specialisation, contrasted by much greater strengths at a European level. The greatest difficulties include the lack of presence among technologies using renewable sources, with the exception of some strong points in solar power (CSP), geothermal and bioenergy.

Italy's capability in the context of energy technologies therefore needs to be evaluated in a potential sense. In addition, the policies on the demand side of technologies have been and are still inadequately related to those on the offer side, as is demonstrated, for example, by the significant financial effort to support energy production from renewable sources, which has given rise to rather incomplete results in terms of the ability to drive innovation and creation of production chains.

Following a period of high levels of fragmentation, in recent years Italy's research into energy technologies is evolving into a more coordinated framework of initiatives; this has also been boosted by the alignment of the key actions in the SET Plan and participation in the Horizon 2020 Programme and Mission Innovation. The Italian research system is well positioned internationally, demonstrating a willingness to seize all the most innovative ideas appearing on an international level.

Developments in European research can impact positively on the process of rationalising the objectives of the research, enhancing and targeting the various national competencies operating in the sector. However, the national research system must be capable of rapidly updating priorities, positions and assessments of competitiveness in the energy technologies sector and allowing the country to make an effective contribution to the chosen futures that will be taken in the context of the European SET Plan, whilst also protecting industrial competitiveness and encouraging the capacity for innovative production.

The process of aligning the national R&D policies with the priorities set out in the SET Plan has been underway for some years now and the Ministry of Economic Development has contributed through the Fund for electrical systems research (funded by the A5 tariff component), which, as part of the recent three-year plans for 2012-2014 and 2015-2017, made a significant link with the SET Plan, allowing, in particular, ENEA [the Italian Energy Agency] and RSE (thanks to the transfer of the results of general interest research – funded in full as part of the Programme Agreements) to compete effectively in the context of both the 7th Framework Programme for EU R&D, achieving the top positions in the classification of European research organisations in terms of funds raised and Horizon 2020. The new

three-year plan for 2019-2021, which aims to strengthen this link with the SET Plan definitively and permanently, has recently been approved.

In 2016, the Italian Ministry of Education and Research (MIUR) also launched the National Research Plan (NRP), the reference tool for the national research strategy, with a budget of €2.5 billion of public resources for research purposes. In particular, the energy sector is considered alongside mobility, a technological area that is 'highly competitive in innovation terms' in which to 'selectively identify specific specialisation sectors on which to concentrate resources'. This envisages 'intensive use of negotiated planning instruments, including through technology clusters, which make it possible to identify specific subsystems on which the implementation of research and innovation policies can play a significant part in promoting the competitiveness of Italian industry'. Lastly, a 'particularly intensive use of matching fund tools and support for the use of competitive European funds is envisaged to allow Italian enterprises and research institutions to detect opportunities and consolidated capabilities at a European level'.

A new National Technology Cluster for energy has also been launched (referred to in section 3.5.i). This is based on a public interest call for mixed public-private groups that intend to execute the objectives set out. The National Technology Clusters are assigned the objective of generating technological and innovative development opportunities for the industrial system at the crossroads between public and private research. This objective can be measured in terms of its capacity to generate shared and agreed technology roadmaps, future technology opportunities and scenarios for Italian industry and, more generally, information tools that are able to support the drafting of informed policies and the channelling of funds dedicated to industrial research.

ii. Current level of public and, where available, private research and innovation spending on low-carbon-technologies, current number of patents, and current number of researchers

Although they are demonstrating an upwards trend compared with previous years, the resources allocated for energy research conducted by public bodies and by publicly controlled enterprises and public contributions to demonstration projects totalled around €0.5 billion in Italy in 2015 compared with €0.8 billion in Germany and €1.1 billion in France.

Figure 62 – Resources allocated for research and development (%)

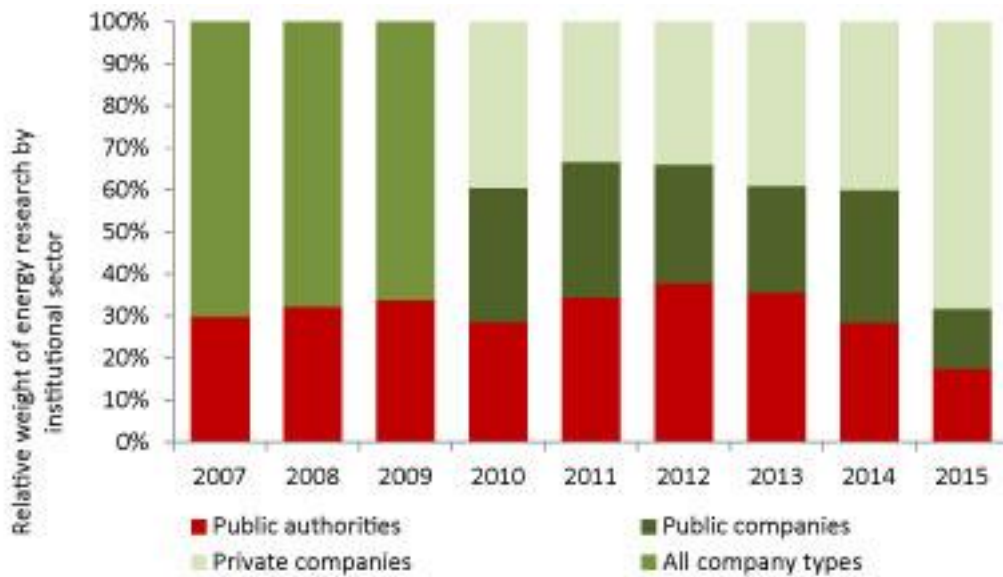
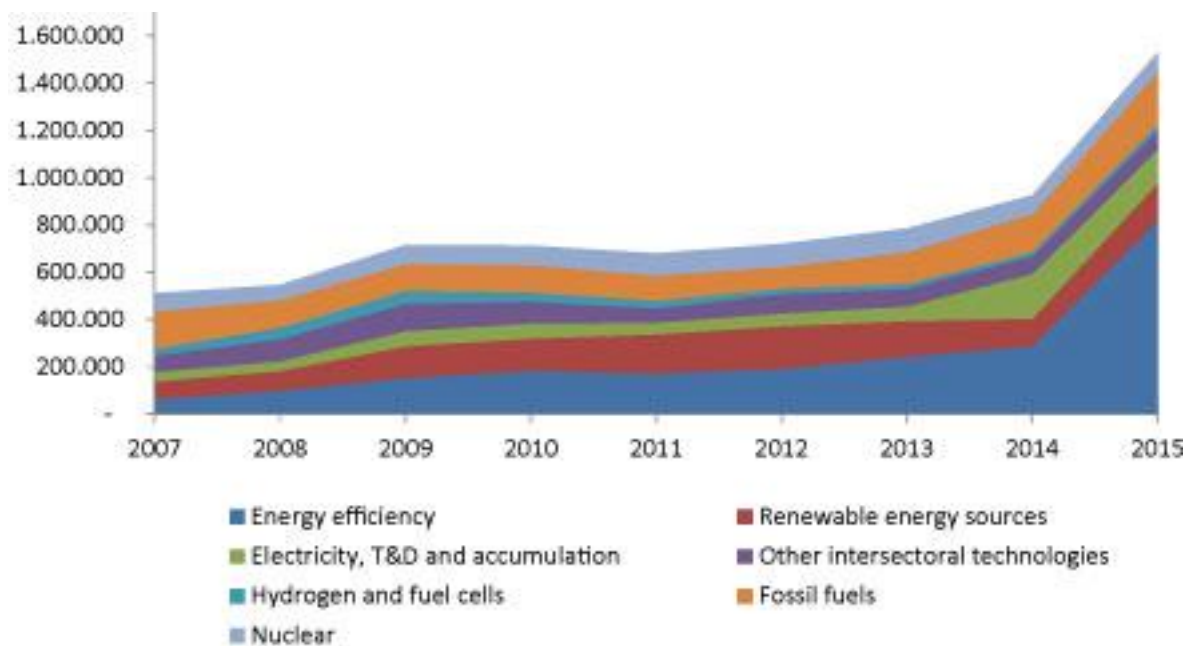


Figure 63 – Trends in resources allocated for energy research and development (€ thousand)



Patents

In terms of patent registration, Italy does not play a major role in the European landscape – and even less so from a quantitative perspective – contributing 0.7% of global energy patents in 2014 compared, for example, to 7.0% from Germany and 3.0% from France; it should also be noted that, as a result of Italy’s virtually unchanged (in terms of percentages) contribution to patents in all the sectors over the past decade, the percentage of Italian energy patents among the total national patents has fallen from 5% to around 3%. Moreover, only 0.34% of all patents applied for worldwide in the electric sector and 0.23% of those relating to sustainable mobility originate from Italy. It must also be stressed, however, that Italy does

not differ greatly from the rest of Europe, which certainly does not shine in the number of innovations submitted, with the exception of Germany (with more than 1 700 electric patents).

The sector in which Italy was relatively more active in the electrical sector in 2016, from an innovative standpoint, is energy storage (a fifth of the total), but also photovoltaics and wind power, which, together, draw 37% of the innovations produced by the country, coming mainly from Lombardy and Lazio. None of the European countries particularly excels in producing patents on the subject of electrical mobility. With the exception of Germany, Italy (23 patents in total) is only performing better than Spain (18) and is still at a similar level to Great Britain (76). Italy's innovative activity is concentrated predominantly on energy accumulation, while little attention is still being paid to hybrid vehicles and recharging stations. As far as our country's regional fragmentation is concerned, Lazio and Veneto produce half of all patents.

The situation is different, however, if you move away from transport research to the sustainability of transport on the roads. Italy performs well here, at least in terms of grams of CO₂/km emitted by newly registered vehicles, which is below the European Union average, only coming behind France. This result was also obtained thanks to the historical tendency to buy smaller cars, a subject that will have to be borne in mind in Italy's future policy choices; thanks to the most recent regulations on this subject, Italy will be able to make effective use of bio-methane.

Start-ups

Lombardy is still the most productive Region for the setting up of new innovative entrepreneurial activities (one in four energy start-ups operates in Lombardy). Energy start-ups are also present in high numbers in the northern regions and in Lazio, but it is interesting to note that these areas are, on average, more active than other sectors on the patent front; there are no particular geographical differences in this area. The size of the enterprise is certainly still the main critical element: the overwhelming majority of Italian start-ups invoice less than €500,000 – both in the energy sector (over 90%) and in other sectors – and there are few cases where the workforce exceeds ten employees (around 5%). The main difficulty when it comes to growth, in addition to those that often have clear organisational limits, is in raising capital.

The most obvious delay currently affecting Italy is the lack of a mature Venture Capital market. However, given the constant growth of this sector, the impact that these enterprises have on the national economy is starting to become significant; this can be quantified in added value that can be quantified at around €3.3 billion overall, of which around 15% is generated in the energy sector alone. The impact is still marginal in terms of employment, which can be evaluated at around 60,000 jobs (more than half of which are in northern Italy), only 8,000 of which are in the energy sector, a number that is, however, destined to grow in the near future, given the forecasts and the ever-increasing attention being paid to this type of entrepreneurial activity.

iii. Breakdown of current price elements that make up the main three price components (energy, network, taxes/levies)

Overall spending by the Italian system on electricity consumption is estimated as being about €52.5 billion in 2017, split as follows:

- 40% on retail services (spending on energy supply on the market⁴², spending on marketing and retailing, spending on supplying dispatching services);
- 14% on network services (spending on transmission, distribution and metering services);
- 28% on general system charges for correct operation and economic and environmental sustainability of the country's system (A components, UC components, MCT component);
- 18% on taxes (excise duty, VAT).

Compared with 2016, the items experiencing the greatest growth have been retail services (+11.6%) and network services (+2.7%), while those in sharp decline have been general charges (-11.1%) and excise duty (-9.4%). Overall, spending has increased by just under 0.7% (but a net reduction of 7% compared with the last 5 years). It is also observed that, in absolute terms, the increase of almost €2.5 billion in the last year recorded by the marketing and sales, transmission/distribution and VAT revenue items was compensated for by the reduction in general system charges and excise duty revenue. Among the general charges, the component that played a greater role is the A3 component (to cover incentives for renewable sources and similar), which reduced by nearly €1.8 billion.

With reference to the retailing item, there was an increase in supply (+22.4%) and marketing-retail sales (+2.8%), and a decrease in expenditure to cover the costs of purchasing resources for dispatching services (-17%). In particular, supply, which represents 72.5% of the retail services, was affected due to a significant increase in thermo-electric production at higher cost due to the rise in fuel prices on the main markets (effect on National Single Price with an average increase of around +11.2 euro/MWh). It is observed that the increase in production by fossil plants served to cover the increase in demand (+2.1%), taking into account both the contribution from foreign trade and that from renewable generation (mainly solar photovoltaic and wind power). Marketing sales, i.e. income from the intermediary, which represents 12% of the items included in the retail services, has, however, been affected by an increase that can easily be traced back to the increase in 'marketing and sales' fees that began in 2016; this was a decision by the ARERA and affected customers in the enhanced protection scheme⁴³. Lastly, expenditure on purchasing resources for dispatching services decreased, mainly thanks to the reduction in revenue collection from the uplift payment fee (-12.3%) and from that to cover the costs incurred for the remuneration of the relevant plants called for essential servicing (-52%). In addition, the major significance of the uplift component (70.3%) on expenditure on purchasing resources for dispatching services is confirmed.

⁴² Spending on purchasing energy incurred by end customers belonging to the free market was estimated on the assumption that all purchases are made from the Power Exchange. On this assumption, the volume supplied by the free market will be the difference in total purchases on the Exchange (net of hydroelectric pumps consumption) less the quantities purchased by the Single Buyer for customers in the enhanced protection scheme, monetised by the annual weighted average of the PUN resulting from the day-before market.

⁴³ The marketing and retail expenses incurred by the end customers belonging to the Free Market were estimated by applying the marketing and sales component of the enhanced protection service to the sampling points of the free market, this component being calculated, however, on the basis of the average costs incurred by enterprises in the free market.

To simplify matters, the general charges group together the tariff components intended to cover the general system charges (components A) and comparable charges (components UC and MCT, since they derive from regulatory requirements). The type A components accounted for around 92% of the full amount of the item ‘general charges’; the single component funding incentives for renewable and similar sources (A3) accounted for 85%, a percentage that can be confirmed in line with that of previous years.

The network services refer to the tariff components laid down by the ARERA to cover the costs of transmission, distribution and metering services. The distribution system account for around 75.2%; in terms of variation, however, on an overall increase of almost €200 million compared with 2016, the distribution percentage was around 60%. The total amount for network services has not seen a significant change compared with recent years and still stands at around €7 billion.

Dividing the overall cost by the national level of consumption gives an estimate of the unit cost of electricity for the community as a whole. In particular, last year, in 2017, this unit cost is estimated to be 17.39 euro cents for each kWh retrieved, around 1.4% less than in 2016 and around 4.7% less than 2012 (in real terms 2010⁴⁴ the reduction between 2012 and 2017 is around 6.7%).

iv. Description of energy subsidies, including for fossil fuels

Parliament assigns to the Ministry of the Environment and Protection of Natural Resources and the Sea the task of drawing up a ‘Catalogue of Environmentally Damaging Subsidies and Environmentally Advantageous Subsidies’ (as provided for by Article 68 of Law No 221 of 28 December 2015, containing measures for the green economy and the efficient use of resources). This is an inventory showing the existing subsidies in Italy, with particular emphasis on their environmental impact.

As set out in the legislation, Parliament intended the term ‘subsidy’ to be understood in the broadest sense, including, among other things, direct incentives, exemptions, tax reductions and discounts, tax relief and implicit subsidies.

The subsidies catalogue serves as a useful tool:

- to identify the area of intervention for a possible reform of the general taxation system, by applying the PPP (‘polluter pays principle’), which improves the functioning of the market.
- to identify measures that contribute to an environmental tax reform (reduction in fiscal pressure that encumbers the labour productivity factor and enterprises with the concurrent recovery of revenue through forms of environmental taxation that are levied on pollution, natural resources, consumption and production that is damaging to the environment);
- and, above all, to identify areas where ‘tax expenditure’ can be reduced in general.

Overall, the Ministry of the Environment and Protection of Natural Resources and the Sea has identified 161 environmental subsidy measures that are relevant to all sectors of the national economy (100 measures are ‘tax expenditure’ and 61 ‘direct subsidies’), with a total value of

⁴⁴ The carry rate was calculated by referring to the average annual consumer price index for blue- and white-collar households (FOI index) net of tobacco since the FOI index is used by the Italian National Statistical Institute (ISTAT) to determine the monetary revaluation coefficient.

€41.3 billion. In particular, for the purposes of the INECP 57 measures have been identified that affect the energy sector, totalling €30.6 billion in 2017; of these, €16.9 billion is made up of fossil fuel subsidies (45 measures).

The Italian government volunteered to be subject to the G20 peer review process on fossil fuel subsidies. In fact, since the G20 (Pittsburgh summit) in 2009, Italy has committed to ‘streamline and eliminate the inefficient fossil fuel subsidies that encourage wasteful use of resources’ in the medium term. Inefficient fossil fuel subsidies encourage waste and market distortions, prevent investment in clean energy and undermine efforts to tackle climate change. In the absence of timeframes and fully shared methodology, with effect from 2015 the G20 initiated a voluntary peer review programme of national reports on fossil fuel subsidies (two countries each year: one advanced economy and one emerging economy).

This exercise, which involved China and the USA in 2016, and Mexico and Germany in 2017, entailed an examination of Italy and Indonesia in 2018; the reports were presented at the G20 in Japan in April 2019. Argentina and Canada (Presidencies in 2018 of G20 and G7 respectively) are the candidates for the 2019 review; other countries could also be added later.

The tables below list a) the 30 subsidies which have a significant environmental impact for the Energy and Climate Plan and that have been identified as those to be examined and assessed in more depth as a priority, including with the Authorities and representatives of the citizens and enterprises involved, in order to identify any compensation (detailed priority list); b) the 10 subsidies that require further technical analysis (secondary list to be analysed in more technical detail); c) the 3 subsidies to be reformed at a Community or global level; d) the 12 energy subsidies that are favourable to the environment. Complete, evidence-based estimates of the financial impact for 2016 and 2017 are almost complete; the drafting process for 2018 is underway.

Table 62 – list of energy subsidies, including for fossil fuels

No	Name	Reference standard	Financial impact (€ million)	
			2016*	2017*
1	Reduction in excise duty on gas oil emulsions or fuel oil in water used as fuel or combustibles	Article 21-bis of Legislative Decree No 504/1995 (Environmental Code), as amended by Article 1(634) of Law No 147/2013	2.20	2.20
2	Exemption from consumption tax for lubricating oils used in the manufacturing and processing of natural and synthetic rubber	Article 62(2) of the Environmental Code	1.00	1.00
3	Reduction in excise duty for fuels used in passenger and goods transport by rail	Table A, point 4 of the Environmental Code	11.15	7.60
4	Exemption from excise duty on fuels for drainage and remediation of waterlogged soils in areas affected by flooding	Table A, point 6 of the Environmental Code	0.50	0.50

5	Exemption from excise duty on fuels for the lifting of water to promote the cultivation of rural funds on reclaimed land	Table A, point 7 of the Environmental Code	0.50	0.50
6	Reduction in excise duty on fuels for experimental trials and inspection of aircraft and marine engines	Table A, point 8 of the Environmental Code	0.50	0.50
7	Reduction in excise duty on natural gas used in shipyards, in fixed engines and in field operations for the extraction of hydrocarbons	Table A, point 10 of the Environmental Code	0.27	0.27
8	Exemption from excise duty on electricity produced by gasification plants	Table A, point 11-bis of the Environmental Code	0.50	0.50
9	Reduction in the standard excise duty rate on fuels used or taxis	Table A, point 12 of the Environmental Code, Prime Ministerial Decree of 20 February 2014, as required by Article 1(577) of Law No 147/ 2013; Article 1(242) of Law No 190/2014	12.66	10.76
10	Reduction in excise duty on fuels for ambulances	Table A, point 13 of the Environmental Code	2.90	2.60
11	Exemption from excise duty on energy products used for the production of magnesium from seawater	Table A, point 14 of the Environmental Code	0.50	0.50
12	Reduction in excise duty on LPG used in centralised plants for industrial uses and used by urban and suburban buses used for public service	Table A, point 15 of the Environmental Code	11.66	11.40
13	Exemption from excise duty on energy products injected into blast furnaces for manufacturing processes	Table A, point 16 of the Environmental Code	1.00	t.b.q.
14	Reduction in costs for national armed forces	Table A, point 16bis of the Environmental Code	24.90	29.60
15	Flat-rate deduction from taxable income for operators of fuel distribution installations	Article 21(1) of Law No 448/1998; Article 6(3) of Law N 388/2000; Article 1(129) of Law No 266/2005; Article 1(393) of Law No 296/2006; Article 1(168) of Law No 244/2007; Article 1(8) of Legislative Decree No 194/2009; Article 2(5) of Legislative Decree No 225/2010;	51.00	51.00

		Article 34(1-3) of Law No 183/2011		
		Presidential Decree No 277/2000; Article 6(2) of Legislative Decree No 26/2007, and related legislation; 2) Article 61(4) of Decree Law No 1/2012; Article 24-ter of the Environmental Code. This article was inserted in the Environmental Code by Article 4-ter(1)(f) of Decree-Law No 193/2016 converted, with amendments, by Law No 225/2016 (Relief understood as a continuation of Article 6(c)(2) of Legislative Decree No 26/2007)	1 264.42	1 257.34
16	Reimbursement of the higher charges from the increase in excise duty on gas oil used as fuel for haulage of goods and other categories of passenger transport			
17	Reduction in excise duty on natural gas used exclusively for industrial thermoelectric uses by parties with annual consumption of more than 1 200 000 ³	Article 4 of Law No 418/2001; Article 2(11) of Law No 203/2008	58.11	58.11
18	Use of energy products in agricultural work and similar	Table A, point 5 of the Environmental Code	830.43	843.20
19	Gas oil and LPG used for heating purposes in areas that are disadvantaged from a geographical or climatic perspective (mountainous areas, Sardinia, smaller islands)	Article 8(10)(c) of Law No 448/1998 and Article 2(12) of Law No 203/2008; Article 1(242) of Law No 190/2014	219.40	159.60

20	Direct or indirect production of electricity by plants subject to the declaration provided for by the provisions governing tax on electricity consumption	Table A, point 11 of the Environmental Code	365.60	365.60
21	Interministerial Price Committee Order 6/1992 ('IPC6')	Provision No 6/1992 CIPE (Interministerial Committee for Economic Planning)	582.50	445.90
22	VAT reduction for electricity for domestic use	Table A, part III of Presidential Decree No 633/72 (VAT rate reduced to 10%)	1 008.90	t.b.q.
23	VAT reduction for electricity and gas for use by extraction, agricultural and manufacturing companies	Table A, part III of Presidential Decree No 633/72 (VAT rate reduced to 10%)	t.b.q.	t.b.q.
24	VAT reduction for crude mineral oils, fuel oils	Table A, part III of Presidential Decree No 633/72 (VAT rate reduced to 10%)	t.b.q.	t.b.q.
25	VAT reduction for petroleum products for agricultural use and for fishing in internal waters	Table A, part III of Presidential Decree No 633/72 (VAT rate reduced to 10%)	233.00	t.b.q.
26	VAT reduction for methane gas and LPG used for domestic purposes for cooking and hot water production	Table A, part III of Presidential Decree No 633/72 (VAT rate reduced to 10%)	t.b.q.	t.b.q.
27	Reduction in excise duty on energy products for vessels sailing exclusively within the port	Article 1(367)(2-ter) of Law No 208/2015	1.80	t.b.q.
28	Deductible on production rates for the production of natural gas and oil (royalties)	Article 35 of Decree Law No 83/2012	52.00	t.b.q.
29	Funds for research, development and demonstration for hydrocarbons (oil and gas) and for coal		0	t.b.q.
30	Tax relief on fringe benefits for workers who use their company cars for mixed purposes (employee company car)	Article 164 of Presidential Decree No 917/1986	t.b.q.	t.b.q.
Total subsidies for environmentally harmful energy (including fossil fuels) to be reformed as a matter of priority			4 737 40	3 248 68

t.b.q. = to be quantified

Source: G20 Fossil Fuels Subsidies Peer Review Self-Report of Italy (<https://www.minambiente.it/pagina/economiaambientale>)

(*) Note: differences from one year to the next may be due to differences in availability of data and estimates. It is highlighted, however, that the financial valuation reported may not correspond to potential revenue that the Government could collect or save if the subsidies on these fossil fuels were to be removed.

Table 63 – List of subsidies for environmentally harmful energy (including fossil fuels): technical details to be added for the secondary list

No	Name	Reference standard	Financial impact (€ million)	
			2016*	2017*
1	Different tax treatment for petrol and diesel (including VAT)	Annex I of the Environmental Code	6,061.29	5,990.20
2	Exemption from excise duty on electricity used in railways	Article 52(3)(c) of Legislative Decree No 504/1995 (Environmental Code)	64.50	67.50
3	Exemption from excise duty on electricity used in urban and long-distance transport lines	Article 52(3)(d) of Legislative Decree No 504/1995 (Environmental Code)	7.70	7.70
4	Exemption from excise duty on electricity used in households with outputs less than or equal to 3 kW and monthly consumption of less than or equal to 150 kWh	Article 52(3) (e) of Legislative Decree No 504/1995 (Environmental Code)	634.08	634.08
5	Guarantees on export-credit for energy production plants fuelled by coal, oil and natural gas in third countries	Legislative Decree No 143/1998 Title I supplemented by Legislative Decree No 170/1999	t.b.q.	t.b.q.
6	Exemption on electricity supply for end customers using immediate or emergency interruptibility services	Article 30(19) of Law No 99/2009	98.00	98.00
7	Help for operators at risk of carbon leakage	Article 10 of Decree Law No 221/2015; Section 26 of European Communication C(2012) 3230	t.b.q.	t.b.q.
8	Tax relief for companies with heavy electricity consumption	Legislative Decree No 79/1999; Ministerial Decree of 5 April 2013; ARERA Resolution No 921/2017/R/eel	0.00	626.00
9	VAT reduction for urban transport taxi service	Article 10(1), No 14 of Presidential Decree No 633/1972	t.b.q.	12.70
10	VAT reduction for administration of methane gas used for combustion for civil purposes limited to 480 m ³ per year	Table A, part III of Presidential Decree No 633/72 (VAT rate reduced to 10%)	t.b.q.	t.b.q.
Total subsidies for environmentally harmful energy (including fossil fuels): technical details to be added for the secondary list			6,865.57	7,436.18

t.b.q. = to be quantified

Source: G20 Fossil Fuels Subsidies Peer Review Self-Report of Italy (<https://www.minambiente.it/pagina/economia-ambientale>) to which the estimates for measures 7-10, which are energy subsidies, have been added, but not to SBB.

(*) Note: differences from one year to the next may be due to differences in availability of data and estimates. It is highlighted, however, that the financial valuation reported may not correspond to potential revenue that the Government could collect or save if the subsidies on these fossil fuels were to be removed.

Table 64 – List of subsidies for environmentally harmful energy (including fossil fuels): to be subject to international reform

No	Name	Reference standard	Financial impact (€ million)	
			2016*	2017*
1	Exemption from excise duty on energy products used as fuel for air navigation other than private aviation and for training flights	Table A, point 2 of Legislative Decree No 504/1995 (Environmental Code)	1,551.10	1,605.90
2	Exemption from excise duty on energy products used as fuel for maritime navigation	Table A, point 3 of Legislative Decree No 504/1995 (Environmental Code)	456.90	496.00
3	Issuance of ETS allowances assigned free of charge	Articles 20-23 of Legislative Decree No 30/2013; Commission Decision No 2011/278/EU of 27 April 2011, Commission Decision No 2013/448/EU of 5 September 2013		394.63
Total subsidies for fossil fuels to be subject to international reform			2,451.99	2,496.53

t.b.q. = to be quantified

Source: G20 Fossil Fuels Subsidies Peer Review Self-Report of Italy (<https://www.minambiente.it/pagina/economia-ambientale>).

(*) Note: differences from one year to the next may be due to differences in availability of data and estimates. It is highlighted, however, that the financial valuation reported may not correspond to potential revenue that the Government could collect or save if the subsidies on these fossil fuels were to be removed.

Table 65 – List of energy subsidies with a positive environmental impact

No	Name	Reference standard	Financial impact (€ million)	
			2016*	2017*
1	Deduction for purchasing furniture and large domestic appliances above class A+ (impact uncertain)	Article 16(2) of Legislative Decree No 63/2013, as amended by conversion law No 90 of 3 August 2013 amended by Article 7(2-bis) of Legislative Decree No 47 of 28 March 2014, converted, with amendments, by Law No 80/2014 and, most recently, by Article 1(3)(b)(3) of Law No 205/2017	199.4	
2	Particularly favourable scheme for use-efficiency systems created prior to Legislative Decree No 115/2008 and ORC Article 12 of Law No 221/2015 cycle systems for self-generation of electricity		t.b.q.	t.b.q.
3	Exemption from excise duty for electricity produced by plants powered by renewable sources with available power exceeding 20 kW	a) Article 1(911) of Law No 208/2015; b) Article 52(3)(b) of the Environmental Code b) Article 52(3)(b) of the Environmental Code	49.15	49.15
4	Tax credits when purchasing vehicles powered by methane or LPG or electric vehicles or for the installation of plants powered by methane and LPG	Article 1(2) of Legislative Decree No 324/1997; Article 1(54) of Law No 239/04; 5-sexies of Legislative Decree No 203/2005; Prime Ministerial Decree 20/02/2014 (see Article 1, 577 of Law No 147/2013)	7.00	7.00
5	Tax credits on district heating networks fed by biomass and geothermic energy	Article 8(10)(f) of Law No 448/1998	27.05	23.66
6	Direct or indirect production of electricity by plants subject to notification under the provisions governing tax on electricity consumption. Exemption for vegetable oils that have not been chemically modified	Table A, point 11 of the Environmental Code	t.b.q.	t.b.q.

7	Incentives for energy produced by plants powered by sustainable biomass, biogas and bioliquids	Article 1(149) to (151) of Law No 208/2015	t.b.q.	t.b.q.
8	Incentives for electricity produced by renewable sources other than photovoltaic	Ministerial Decree 23 June 2016	5,761.00	5,628.40
9	Feed-in tariff: incentive system dedicated to photovoltaic solar plants (from 2005 to 2012)	Ministerial Decrees 28/07/2005 and 06/02/2006 (Feed-in Tariff I); Ministerial Decree 19/02/2007 (Feed-in Tariff II); Ministerial Decree 06/08/2010 (Feed-in Tariff III); Ministerial Decree 05/05/2011 ⁰ (Feed-in Tariff IV); Ministerial Decree 05/07/2012 (Feed-in Tariff V)	6,297.00	6,404.00
10	Promotion of energy efficient measures and production of energy by thermal RES (Cogeneration and high-yield cogeneration)	Legislative Decree No 102/2014; Ministerial Decree of 5 September 2011; Interministerial Decree of 28 December 2012 and Legislative Decree 102/2014 and Interministerial Decree of 16 February 2016 (Feed-in Tariff 2.0)	t.b.q.	t.b.q.
11	Incentivisation for measures encouraging technological and industrial development	Article 32 of Legislative Decree No 28/2011	t.b.q.	t.b.q.
12	Deduction of 65% for energy upgrading measures for existing buildings of any cadastral category, including rural, inhabited or owned	Article 1(344-347) of Law No 296/2006, extended by Article 1(48) of Law No 220/2010, Article 11(2) of Legislative Decree 83/2012; Article 14 of Legislative Decree No 63/2013 amended by Law No 90/2013 replaced by Article 1(139)(b) of Law No 147/2013 and, most recently, amended by Article 1(3)(a) of Law No 205/2017; Article 1(74) of Law No 208/2015	984.4	1,397.20

Total subsidies in the energy sector with a positive environmental impact	13,341.61	13 712.20
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t.b.q. = to be quantified

(*) Note: differences from one year to the next may be due to differences in availability of data and estimates. It is highlighted, however, that the financial valuation reported may not correspond to potential revenue that the Government could collect or save if the subsidies on these fossil fuels were to be removed.

5 IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES⁴⁵

5.1 Impact of planned policies and measures described in section 3 on energy system and GHG emissions and removals, including comparison with projections with current policies and measures (as described in section 4).

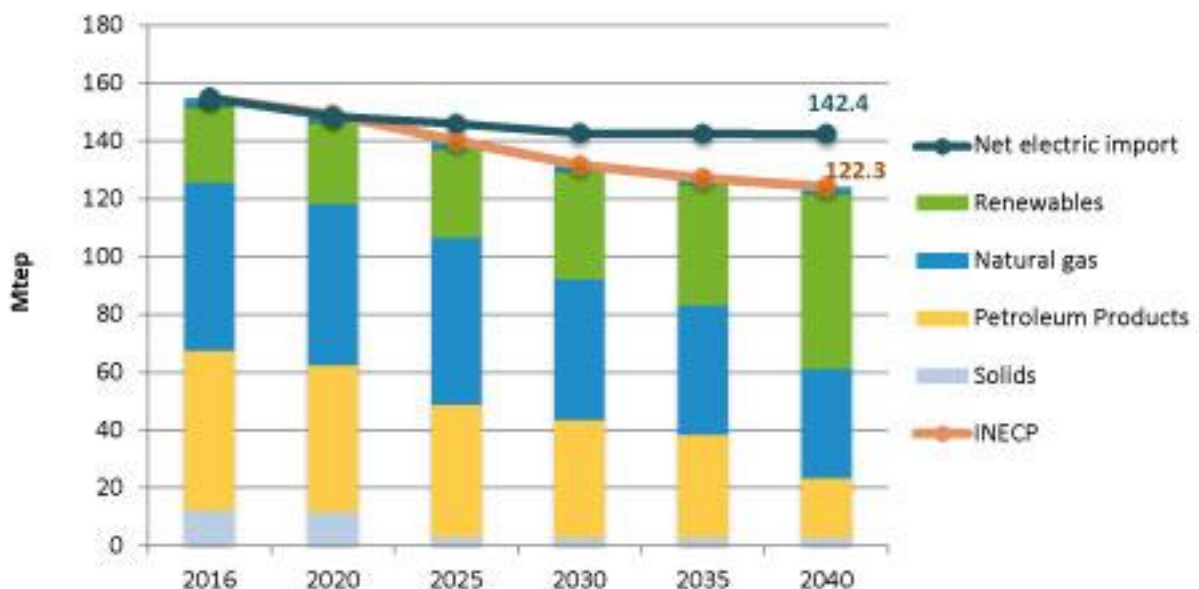
i. Projections of the development of the energy system and GHG emissions and removals as well as, where relevant, of emissions of air pollutants in accordance with Directive (EU) 2016/2284 under the planned policies and measures at least until ten years after the period covered by the plan (including the last year of the period covered by the plan), including relevant Union policies and measures.

The combined action of policies, actions and investments provided for by the Energy and Climate Plan results not only in a reduction in demand due to energy efficiency, but also affects the way in which energy is produced and used, which differs from the trends in the past or developments in the system with current policies and measures. The drive towards net-zero emissions by 2050, in line with the long-term strategy, will trigger a complete transformation of the energy system and require new authorisation measures and policies after 2030.

The climate challenge presents complex problems both in terms of supply, dependence and security, and in terms of energy costs and, in particular, the issue of decarbonising the entire energy system, not only in the immediate future but also in the long term.

As shown in Chapter 2, the Energy and Climate plan provides efficiency, which transforms the energy system and aims to replace fossil fuels with renewables, thereby decarbonising the national production system. The graph and table below show the results of the INECP scenario projections up to 2040 and a comparison with the base scenario projections.

Figure 64 – Development of gross inland consumption in the baseline and INECP scenarios [Source: RSE]



⁴⁵ Planned policies and measures are options under discussion and have a realistic chance of being adopted and implemented after the date of submission of the national plan. The resulting projections under section 5.1.i therefore include not only implemented and adopted policies and measures (projections with current policies and measures), but also planned policies and measures

Table 66 – Primary and final energy consumption (for each sector), projections 2020-2040 in the INECP scenario (ktoe) [Source: RSE].

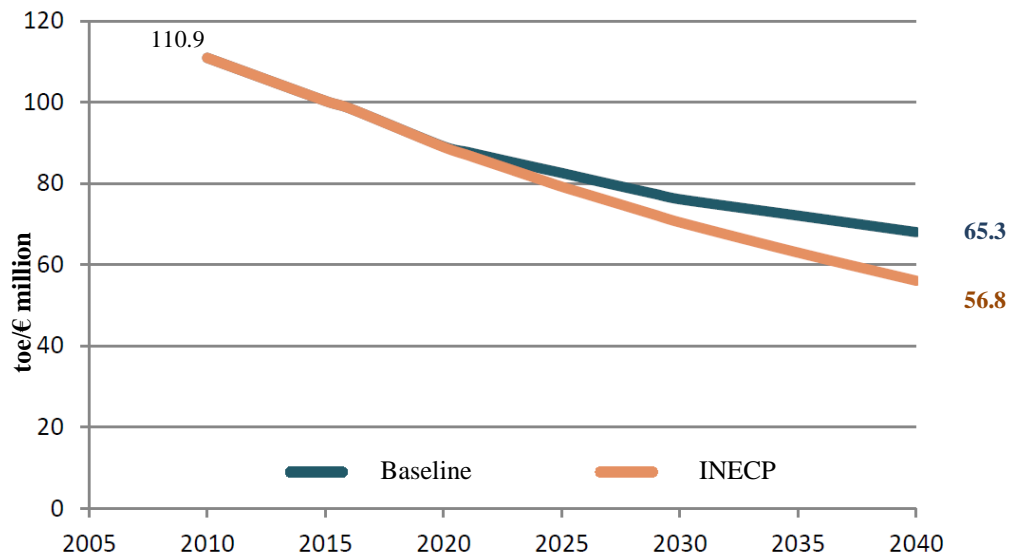
INECP Scenario	2020	2025	2030	2040
Gross inland consumption	149,111	140,071	131,640	124,069
Solids	11,640	2,966	2,812	2,729
Petroleum products	50,711	45,802	40,546	20,689
Natural gas	55,838	57,796	48,913	37,709
Electricity	3,162	2,812	2,451	2,653
Renewables	27,760	30,695	36,918	60,288
Primary energy consumption*	142,441	133,291	124,690	116,359
Final energy consumption	116,393	109,746	103,750	94,789
Breakdown by sector				
Industry	26,536	26,054	25,049	25,083
Residential	31,974	29,218	27,176	23,275
Tertiary	15,700	14,648	13,275	14,184
Transport	39,240	37,024	35,357	29,433
Agriculture	2,942	2,803	2,893	2,814
Breakdown by source				
Solids	2,013	1,928	1,919	1,802
Petroleum products	42,405	37,578	32,244	15,611
Natural gas	33,516	30,705	28,331	23,841
Electricity	25,209	25,300	26,037	30,803
Derived heat	4,127	4,530	4,735	4,615
Renewables	9,122	9,705	10,485	18,116
Final non-energy consumption	6,670	6,780	6,950	7,710

* Primary consumption does not include non-energy uses, which are included in gross inland consumption.

The decrease in gross inland consumption is not a result of the reduction in GDP or the levels of sectoral activity, but is mainly the result of technological changes and a fuel switch on the demand and supply sides. The replacement of fossil fuels with renewable sources will continue, accelerating after 2030 towards full decarbonisation.

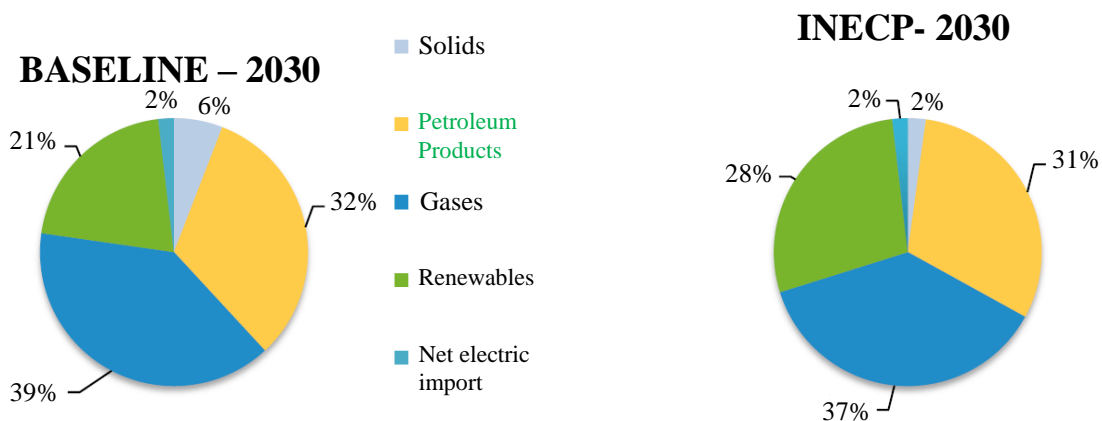
The increase in energy efficiency, resulting from the combined effect of all policies, is one of the main factors leading to the reduction of emission intensity in the long term, as is evident from the continuously declining energy intensity in economic activity up to 2040.

Figure 65 – Developments in energy intensity in 2040



The base scenario is already characterised by energy efficiency improvements that offset the increase in consumption driven by the economic growth up to 2040; these improvements are not, however, capable of maintaining the same rate of reduction in primary consumption in the period 2010-2020. The policies and measures in the Energy and Climate Plan do, however, trigger an even more rapid reduction in energy intensity, with average annual reduction of 2.3% in the period 2020-2040, so as to allow the downward trends in primary consumption to continue.

Figure 66 – Mix of primary demand in 2030



Renewable sources are increasingly replacing consumption of fossil fuels, with primary demand increasing from 16.7% in 2016 to around 28% by 2030 in the INECP scenario.

After 2030, petroleum products will continue to be used in long-distance passenger and goods transport, but the use of these products will be significantly less by 2040 (around 17% of primary mix); this goes hand in hand with the energy sector transformation towards zero emissions by 2050. The decline in these products is most significant in the latter years of the scenario presented, when petroleum in transport is noticeably replaced by biofuels, hydrogen and electrically powered vehicles, both for passenger and goods transport.

In the base scenario, consumption of natural gas is fairly stable until 2030, contributing 39% to the primary energy demand. In the INECP long-term scenario, competition with RES and increasing process and building efficiency leads to a reduction in use of the fossil fuel natural gas (decreasing from 37% in 2030 to just over 30% in 2040).

Projections for energy security in 2040 indicate a sharp reduction in energy dependence, as a result of the combined effect of the increase in national renewable resources and the reduction in imports, particularly of fossil fuels.

Table 67 – Internal energy resources, 2020-2040 projections – INECP scenario (ktoe)

	2020	2025	2030	2040	
National production		37 615	40 295	42 892	47 439
Solids		50	-	-	-
Crude oil	7 005	6 365	4 589	2 440	
Natural gas	4 750	4 340	2 445	1 010	
Renewables*		25 810	29 590	35 858	43 989

* Including non-renewable waste quota

Table 68 – Net imports, 2020-2040 projections- INECP scenario (ktoe)

	2020	2025	2030	2040
Net imports	113 816	102 196	91 248	77,652
Solids	11 590	2 966	2 812	3 006
Crude oil and petroleum products	46 026	41 857	38 457	30 565
Natural gas	51 088	53 456	46 468	39 755
Electricity	3 162	2 812	2 451	2 427
Renewables*	1 950	1 105	1 060	1 899

* Including non-renewable waste quota

Table 69 – Energy dependence, 2020-2040 projections –INECP scenario

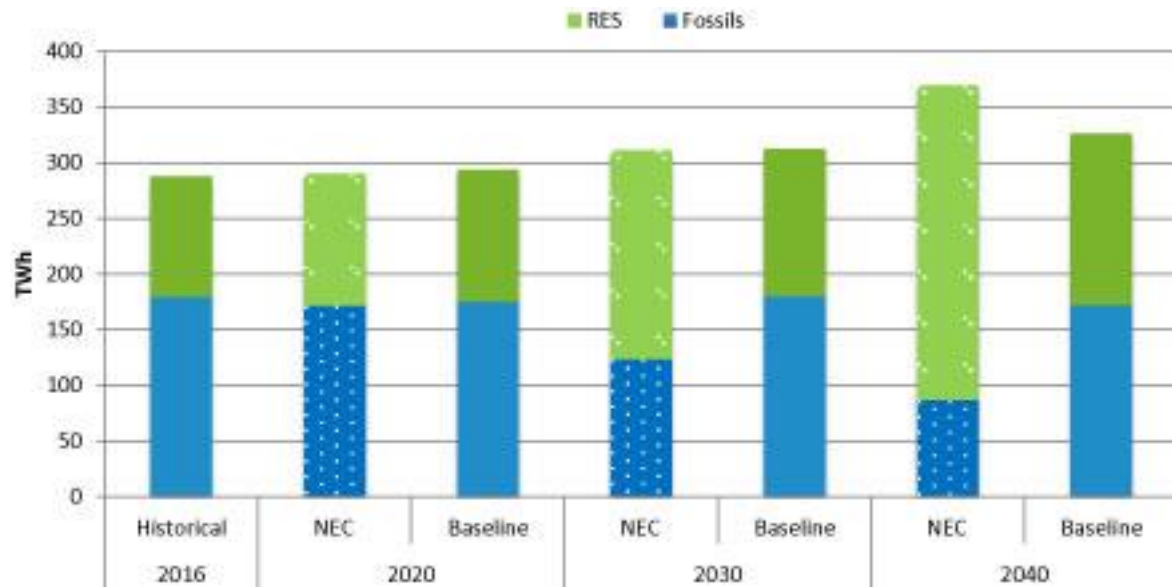
	2020	2025	2030	2040
Energy dependence	75.2%	71.7%	68.0%	62.1%

An extremely important driver in this scenario is the increasingly significant decarbonisation of electricity generation processes. In the base scenario, the EU-ETS mechanism encourages the entry of renewable sources in generation. The plan's targets boost the use of electrical RES, which, in 2030, will provide 187 TWh of electricity.

The need to electrify end-use sectors to accompany the transition to decarbonisation by 2050 with increasingly carbon-free electricity supports the development of renewable electricity sources. The RES contribution will continue to grow up to 2040, reaching production of around 280 TWh. This is thanks in part to the effects of the learning curve that envisages, over time, increasingly low investment costs and renders these technologies competitive. Non-programmable renewable sources, mainly solar and wind, are expected to undergo significant growth; the expansion of these sources is set to continue even after 2030, and will also be managed through the use of significant quantities of storage systems, both on networks (electrochemical and pumping storage) and associated with the generation plants themselves (electrochemical storage). The strong presence of non-programmable renewable

sources from 2040 will lead to a high increase in overgeneration hours. This overproduction will not only be accumulated, but will have to be used in the production of alternative and zero-emission forms of energy such as hydrogen, biomethane, and e-fuels in general, which can be used to promote decarbonisation in sectors that are more difficult to electrify such as industry and transport.

Figure 67 – Development of electrical generation⁴⁶ in 2040 [Source: RSE]



Electrification plays a central role along with energy efficiency, above all in the long term, for decarbonisation in end-use consumption. Demand for the grid reaches 331.4 TWh in 2030 (gross internal electricity consumption of 339.5 TWh), while by 2040 it is close to 390 TWh. While electricity demand is destined to rise, energy efficiency will impact upon the development of other energy carriers. In fact, after 2030, the policies identified in the Plan will continue to encourage a significant improvement in energy efficiency in key end uses (buildings, lighting, cooling and heating, domestic appliances and industry), as well as replacing fossil fuels with electricity and renewables. After 2030, however, further policies will need to be drawn up to accompany the transformation of the energy system towards the 2050 zero emission target.

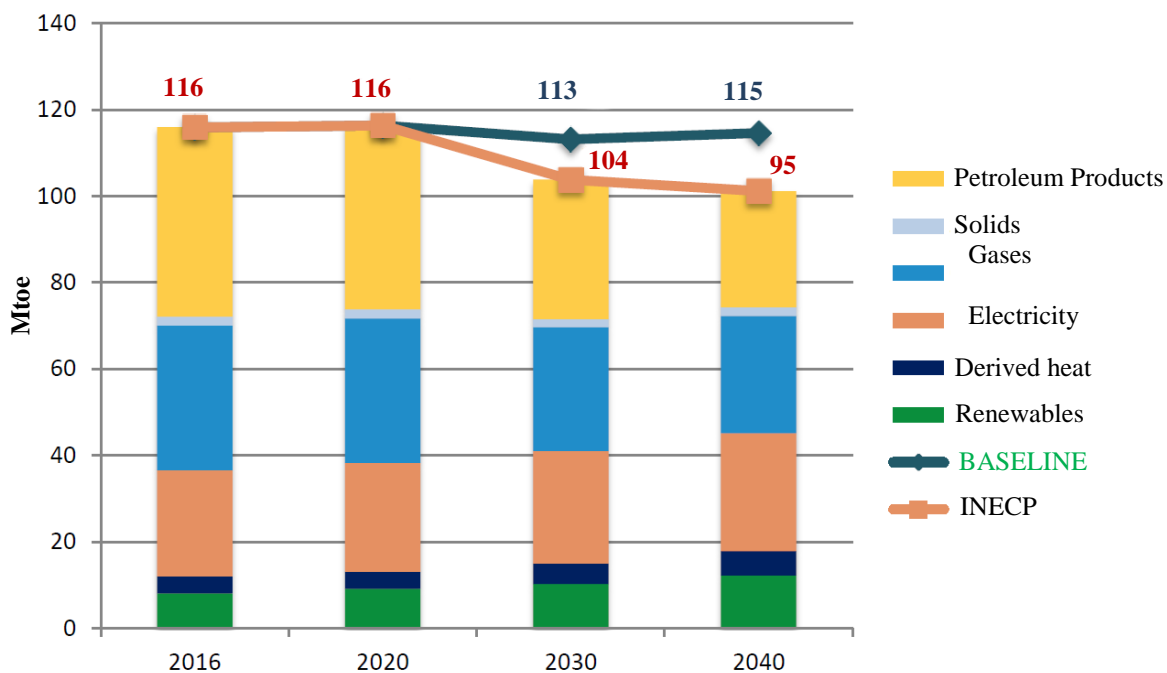
The following are important looking ahead to 2040:

- improvements in end-use technologies and processes (vehicles, residential, heat recovery in industry, etc.);
- continuing measures to renovate and insulate buildings (given the high potential), with average annual rates that could exceed 2% and the replacement of heat-generation systems with other more efficient and renewable systems (heat pumps);
- an increase in electrification of end uses (particularly in the transport sector);
- maintaining the increase in demand for private transport, with measures and investments in private collective transport;
- the reduced heating requirements in new buildings;
- the use of power to X (P2X) forms of energy delivery such as hydrogen, biomethane and liquid e-fuels
- possible primary CO₂ capture and sequestration plants, both in the electricity and industrial

⁴⁶ Excludes electrical production from pumps

sectors, to bring the energy system into line with the pathway to complete decarbonisation by 2050.

Figure 68 – Developments in end consumption by source in 2040 [Source: RSE]



With regard to emissions, historical trends in national emissions and expected developments in the INECP are shown below.

Table 70 – National greenhouse gas emissions and European targets (Mt CO₂eq) – INECP scenario [Source: ISPRA]

	1990	2005	2010	2015	2020	2025	2030
National emissions	520	581	504	433	406	358	328
ETS sectors		248	200	156	144	115	109
ESD/ESR sectors		330	301	274	260	241	216
National flights not subject to ETS	3	3	2	2	2	2	2
ESD/ESR targets *				304	291	243	221
Difference compared with targets				-30	-31	-3	-5

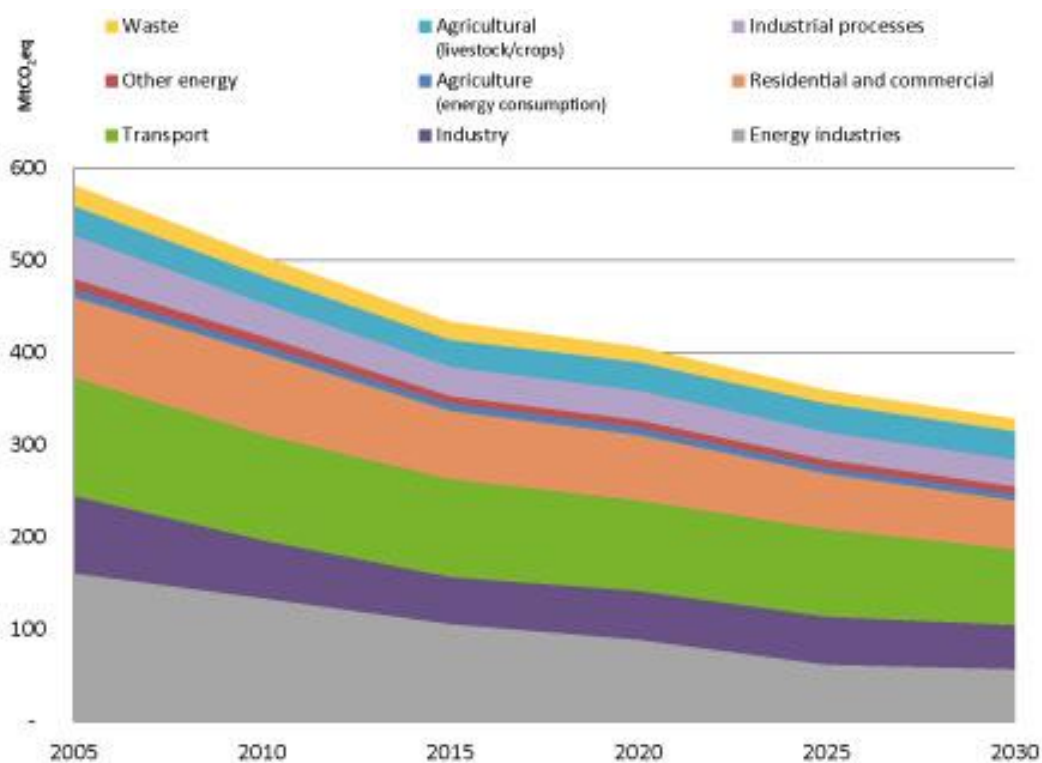
*Target for 2020 as established by ESD Decision (EU) 2017/1471, target for 2030 as established by ESR Regulation (EU) equivalent to a 33% reduction in emissions compared with 2005 levels. The 2025 target is only indicative because it is dependent on the emission levels actually recorded in 2016-2018. NF3 emissions are included in the ESD/ESR post-2020 targets.

 Table 71 – Historical greenhouse gas emissions up to 2015 and according to the INECP scenario, broken down by sector (MtCO₂eq) [Source: ISPRA]

	2005	2010	2015	2020	2025	2030
FROM ENERGY USES, of which:	480	417	353	328	283	256
Energy industries	161	134	106	89	62	57
Industry	84	63	51	53	52	48
Transport*	128	115	106	98	95	82
Residential and commercial	87	88	74	71	60	53
Agricultural energy consumption	9	8	8	8	7	7
Other energy	11	10	8	8	8	8
FROM OTHER SOURCES, of which:	101	87	80	78	75	72
Industrial processes	47	36	32	32	30	29
Crop and livestock agriculture	32	30	29	31	31	31
Waste	22	20	19	16	14	13
TOTAL	581	504	433	406	358	328
Of which subject to ESD/ESR	330	301	274	260	241	216

* With reference to shipping, the data refer to national vessels and movements within ports; international vessels are not included

Figure 69 – Historical greenhouse gas emissions up to 2015 and according to the INECP scenario, broken down by sector (MtCO₂eq) [Source: ISPRA]



Sectoral analysis in the period 2005 – 2030 shows:

- dramatic reduction in emissions in energy industries (-65%), mainly due to a reduction in emissions in the electric power sector. In this sector, emissions are directly linked to electricity production from fossil fuels. The significant growth in electricity production from renewable sources that is needed to achieve the targets is the determining factor;
- in the transport sector, a 36% reduction in emissions due to the substantial electrification of car transport and, to a lesser extent, to the infiltration of biofuels;
- in the residential sector, a 39% reduction in emissions due to the significant building renovation rate, the continued efficiency and increasing electrification of the sector, mainly with regard to heating;
- a significant decline (-41%) in emissions from industry, both as regards energy consumption and as regards processes, concentrated mainly in the period 2005-2015, in part due to the economic crisis and in part to the structural variation in activities and the increase in efficiency of production processes, the impact of which is also evident in the reduction in emissions in the projection years (-7% from 2015 to 2030), despite the assumption of a significant upswing in production;
- emissions from waste substantially unchanged compared with the base scenario due to the absence of further targets and measures;
- as regards agriculture, the measures identified are currently still at the evaluation stage; emissions equal to those in the base scenario have therefore been conservatively cited.

Table 72 – Historical greenhouse gas emissions up to 2015 and according to the INECP scenario, broken down by gases (MtCO₂eq) [Source: ISPRA]

GHG emissions, Mt of CO ₂ eq	2005	2010	2015	2020	2025	2030
Carbon dioxide	495	425	356	331	288	261
Methane	48	47	43	41	39	37
Nitrous oxide	28	19	18	19	18	18
HFCs	7.1	11.4	14.5	14.1	11.6	9.2
PFCs	1.9	1.5	1.7	1.6	1.6	1.6
SF6	0.6	0.4	0.4	0.3	0.3	0.3
NF3	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	581	504	433	406	358	328

ii. Assessment of policy interactions (between current policies and measures and planned policies and measures within a policy dimension and between current policies and measures and planned policies and measures of different sizes) at least until the last year of the period covered by the plan, in particular to establish a robust understanding of the impact of energy efficiency/energy savings policies on the sizing of the energy system and to reduce the risk of stranded investment in energy supply

iii. Assessment of interactions between current policies and measures and planned policies and measures, and between those policies and measures and Union climate and energy policy measures

5.2 Macroeconomic impact and, to the extent feasible, the health, environmental, employment and education, skills and social impacts, including fair transition aspects (in terms of costs and benefits as well as cost-effectiveness) of the planned policies and measures described in section 3 at least until the last year of the period covered by the plan, including comparison with projections with current policies and measures

The INECP scenario can be analysed from the point of view of its macroeconomic impact compared with the scenario with the current policies (or baseline).

The analysis was conducted using three different approaches:

- a standard input/output model based on the sectoral interdependence matrices published by the National Institute for Statistics (based on GSE data);
- the social accounting matrices (SAM) to examine the impact generated by new investments both in the business sector and the household sector (based on ENEA data);
- a General economic equilibrium model (GTAP-GDyn-E) to assess the impact of the new targets on economic growth in Italy and on its competitive position in international trade (based on ENEA data).

Analysis according to the standard Input/Output model

The model is based on the sectoral interdependence matrices (Input/Output tables). These represent an accounting framework that outlines a country's economic structure over a given timeframe, highlighting the interdependencies between the various sectors of which the economy is made up in a concise and immediate manner. The matrices, having been properly converted using specific procedures, allow estimates to be made of the macroeconomic impact (value added, employment) due to variations in end demand in a particular sector in a given year. The matrices are established based on the input-output tables and the uses published on an annual basis by the National Institute for Statistics (Istat). The most recent tables available at the time of writing refer to the year 2014 and are broken down into 63 economic sectors.

One of the methodological obstacles presented by this type of analysis is that, in certain cases, the measures evaluated in the scenarios in the current Plan cannot be associated in any way with the 63 economic sectors in the matrix (with the current policies and INECP). This is the case, for example, with energy production plants that use renewable sources. In order to overcome this problem, the costs of implementing the measures (and the operating and maintenance costs – O&M – in the case of plants producing electricity and heat) have been broken down so as to be able to trace them back to the 63 economic sectors taken into account in the matrix. For example, the investment costs in new photovoltaic plants have been distributed and ascribed partly to the electrical appliance manufacturing sector (inverters, cables, etc.), and partly to that of the manufacture of metal products (support structures), thereby assigning to each cost item a variable price depending on the specific percentage of the total cost. By doing so, it has been possible to simulate the impact on the national economic system of the demand for new actions, associated with renewable sources or energy efficiency, including in the Plan scenarios.

Another element warranting attention is the sometimes substantial share of imports of products needed to implement the evaluated measures in the Plan scenarios. The matrices already include values and coefficients that take into account the share of imports in the

various sectors; however, it cannot be ruled out that, in particular sectors of economic activity (for example those which, when combined, redevelop the photovoltaic sector), this share, despite having already been taken into account, may be underestimated. In order to overcome this problem, the data reported by Istat in the context of the PRODCOM survey on international trade has been used.

The results obtained using the input/output model relate to economic impact, in terms of value added, and direct and indirect employment, both temporary and permanent. The permanent impact relates to employment associated with the use and maintenance of the assets for their entire life cycle, while the temporary impact relates to employment that is limited in terms of time to the design, development, installation and asset creation stages. The effects on employment are grouped into direct effects, relating to employment that is directly attributable to the sector in question, and indirect effects, relating to the sectors supplying the activity in question, either downstream or upstream. Estimated employment is not intended to be understood in terms of workers actually employed in the various sectors, but in terms of AWUs (annual work units), which indicate the amount of work performed in the year by a full-time employee. It is therefore important to bear in mind that the apparent variations that may occur between one year and the next do not necessarily result in an increase or reduction in 'jobs', but to a greater or lesser amount of work required to make the investments or to perform the specific operating and maintenance activities in a given year.

The input/output model has been used to evaluate the gross economic and employment impact (i.e. without taking into account any negative effects in sectors that could be considered to be competitors) of investments in the measures provided for in the INECP scenario. The impact from investments in these measures have been subtracted from this, but in accordance with the current measures scenario; it is possible in this way to recognise the impact of greater investments undertaken in the INECP scenario, equivalent to around €13 billion in the period 2017-2030⁴⁷.

In summary:

- the average additional annual contribution in the period 2017-2030 to the creation of Added Value compared with that in the current policies scenario is estimated at over €7 billion;
- it is estimated that there will be around an additional 117,000 temporary jobs each year (direct and indirect AWU) compared with that calculated for the current policies scenario in the period 2017-2030.

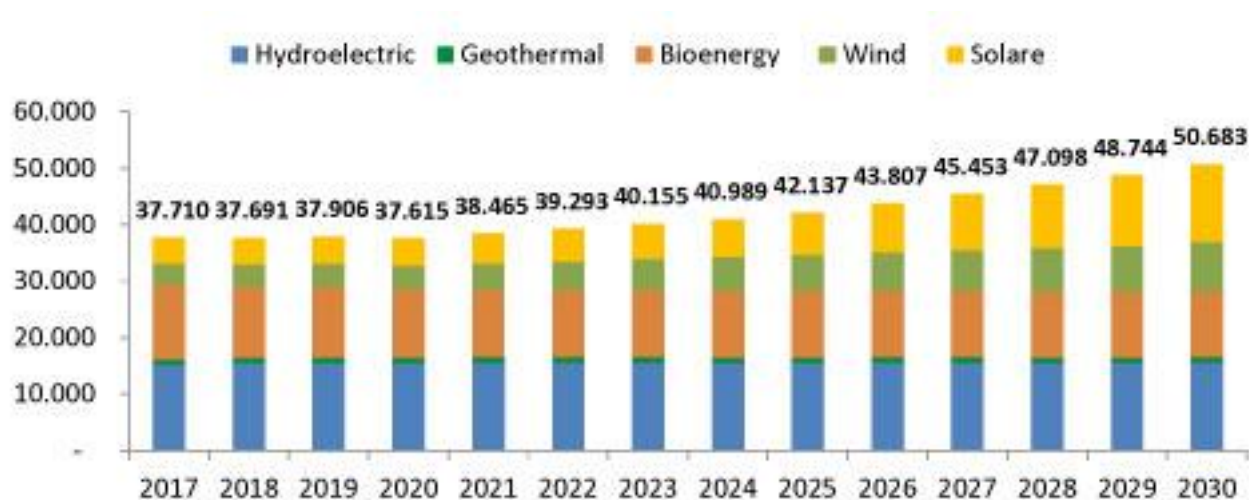
⁴⁷ The results obtained using the input/output model cannot be compared immediately with those obtained using the SAM. In the case of the input/output model, the effects are calculated as the difference between the impact of the INECP scenario and that of the current policies scenario. In the SAM, on the other hand, the evaluations of the impact have been carried out net of a counterfactual scenario that takes into account the possible alternative uses of the resources available to the additional investments required by the INECP, assuming that the investments are split according to the 'historical' spending ratios of the economic agents making the spending decision.

Table 73 – Summary of the main results obtained by implementing the input – output model [Source: RSE, GSE]

SECTOR		Δ annual investments in € billions (2017-2030)	Δ average annual analytical base in € billions (2017-2030)	Δ average annual temporary AWU (2017-2030)
Residential	Building renovation	3.1	2.1	39,000
	Heat pumps (heating and	0.4	0.2	4,000
	Heating and domestic hot	-0.2	-0.2	-3,000
	Cooking	0.0	0.0	0
	Electrical equipment	1.1	0.8	13,000
District heating	Distribution	0.6	0.03	1,000
Tertiary	Building renovation	1.7	1.2	22,000
	Heat pumps (heating and	0.1	0.1	1,000
	Heating and domestic hot	-0.1	-0.0	-1,000
	Cooking	0.0	0.0	0
	Electrical equipment	0.0	0.0	0
	Lighting	0.7	0.5	4,000
Industry	Electric motors and uses	0.1	0.0	1,000
	Cogeneration and boilers	0.1	0.1	1,000
	Processes, including heat recovery	0.3	0.2	3,000
Transport	Cars, motorcycles, vans, buses,	1.9	0.2	3,000
Electrical sector	Bioenergy	0.2	0.1	1,000
	Fossils	-0.2	-0.1	-1,000
	Geothermal energy	0.0	0.0	0
	Hydropower	0.0	0.0	0
	Photovoltaic	2.2	0.9	15,000
	Concentrated solar power	0.1	0.0	1,000
	Wind	0.6	0.4	5,000
Electrical system	Development of national	0.1	0.1	1,000
	Redevelopment of distribution	0.3	0.2	2,000
	Pumping and electrochemical	0.7	0.5	5,000
Total		13.4	7.3	117,000

The histogram below, on the other hand, shows developments in permanent posts (direct and indirect AWU) for each source resulting from the installation of new RES – E plants from 2017 to 2030 according to the INECP scenario. The estimates made demonstrate how, in terms of AWU, employment increases from 37,710 units in 2017 to 50,683 units in 2030, with a positive balance of 12,973 AWU (+34% approximately).

Figure 70 – Trends in permanent posts for each source resulting from the creation of the RES – E power plant according to the INECP scenario [Source: GSE]



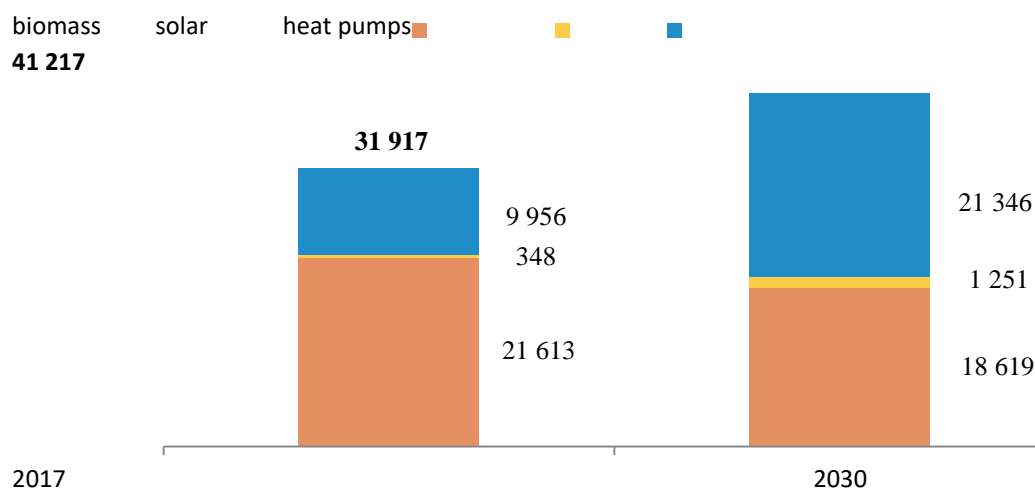
Also taking into account the creation of the power plant powered by fossil fuels, the total employment impact of the electricity-producing sector, in term of AWU, is positive and is equivalent to 6 906 units. In the fossil division, a decrease in employment of 6 067 AWU can be seen between 2030 and 2017 due in particular to the phasing-out of coal.

Table 74 – Permanent posts by source in 2017 and 2030 resulting from the creation of electricity power plants according to the INECP scenario [Source: GSE]

Technology	Permanent AWU 2017	Permanent AWU 2030	Δ Permanent AWU 2030
RES	37,710	50,683	12,973
Hydropower	15,294	16,380	1,086
Wind	3,605	8,706	5,101
Solar	4,598	13,795	9,197
Geothermal	689	783	94
Bioenergy	13,524	11,020	-2,504
Fossils	17,904	11,837	-6,067
Coal	3,841	-	-3,841
Natural Gas	13,583	11,408	-2,175
Petroleum	481	429	-52
Total	55,614	62,520	6,906

The histogram below shows the developments in permanent posts (direct and indirect AWU) for each source resulting from the installation of new RES-T plants in 2017 and in 2030 according to the INECP scenario. The estimates made demonstrate how, in terms of AWU, employment increases from 31,917 units in 2017 to 41,217 units in 2030, with a positive balance of 9,300 AWU (+29% approximately).

Figure 71 – Permanent posts for each source resulting from the creation of the RES-T power plant according to the INECP scenario [Source: GSE]



Analysis according to the social accounting matrix

The social accounting matrix (SAM) takes the form of a square matrix, which records trade relationships that exist in an economic system in quantitative terms. The columns in the matrix indicate the uses of the income from each productive or institutional sector; the rows show the sources of income for each sector.

The structure of the SAM includes the input-output (I/O) matrix of intermediate trade between productive sectors. To this, however, are added the accounts opened in the name of the institutions (households, companies, government); the production factors (labour and capital); capital formation and the rest of the world. In this way, the SAM allows all the relationships that characterise an economic system at the various stages of the production, distribution, utilisation and accumulation of income process to be gathered.

The SAM is a tool that can show the adjustment that the economic system has to make in order to support a change to one of the equilibrium vectors. The tool is able to evaluate the effects at system level of a tax incentive measure, an additional investment, or a change in spending by one of the institutions involved.

In order to analyse the impact of a behavioural change on the economic system as a whole, it is necessary, first of all, to identify the exogenous count (capital formation or households) and to establish the corresponding influencing vector.

The establishment of influencing vectors is based on simplified assumptions relating to the directly activated sectors, such as suppliers of goods and services needed for investment or for the additional expenditure needed to implement the INECP scenario. The impact analysis takes into account two multiplication loops: the production loop and the income distribution loop.

In the first loop, the increase in end demand (for example the costs of renovating buildings, investments in new technologies, etc.) results in an increase in production in the sector directly affected and, through the supply chain for intermediate goods, also in all the other sectors that supply intermediate goods.

The transmission mechanism spreads in the second loop: the increase in production, in fact, results in an increase in remuneration of the production factors; income from the factors is redistributed between the institutions, which in turn increase the end demand for goods and services. It is this multiplication loop that differentiates the SAM from the Leontief matrix and that explains the larger multipliers in the SAM compared with the input – output matrix.

To evaluate the INECP scenario, in which overall investment in new energy technologies is greater than in the scenario with current policies, the impact assessments are carried out net of a counterfactual scenario that takes into account the possible alternative uses for

resources for additional investment required by the INECP scenario. The counterfactual scenario was designed assuming that the investments are split according to the ‘historical’ spending ratios of the economic agents that make the spending decision. In this way, the various economic effects identified are due not to the scale of the investment but to those economic sectors that are activated in the two situations.

The analysis focuses on the impact of investments in new energy technologies, overlooking the impact of the changes in consumption distribution resulting from the savings made on the side of energy bills of companies and households and from the different use of the disposable income.

The estimated SAM for 2010 from CEIS–Tor Vergata was used for these impact analyses; the breakdown was as follows:

- 58 productive sectors (25 services, 29 industry, 1 construction, 3 agricultural),
- 2 production factors (labour and capital),
- 4 institutions (households, companies, government, capital formation)
- rest of the world.

The table below shows a brief overview of the impact estimates performed with SAM. The table only looks at the impact of investments (non-discounted)⁴⁸.

The first column reports the additional investments envisaged in the INECP scenario. The investments are calculated for the period 2017-2030, grouped by similar categories of technologies/measures and expressed in € billion/year. For some types, the INECP scenario envisages lower levels of investment than the current policies scenario. In these situations, the investment shows a negative performance and also an effect on macroeconomic aggregates and on employment.

The other columns represent the impact of additional investment net of the counterfactual scenario.

⁴⁸ Only the temporary effects relating to temporary employment limited to the design, development, installation and asset creation phases are examined

Table 75 – Net impact of the additional investments envisaged in the Target scenario. Yearly average 2017-2030 [Source: ENEA]

	Yearly average 2017-2030 (€ billion/year)	Value Added (€ million/year)	Direct taxation (€ million/year)	Net indirect taxation (€ million/year)	AWU (average number of full-time employees/year)
Fossil fuel-fired power	-0.2	-212	-58	-27	-2 188
Photovoltaic	2.0	542	163	21	6 441
Other RES	0.9	686	189	79	7 271
Industry	0.4	417	117	47	4 931
Electric uses and heating and kitchen uses	1.6	137	94	-147	5 052
Renovation of residential	-0.2	-24	-13	14	-743
Electric uses and tertiary	3.1	1 093	384	-157	13 341
Renovation of tertiary	0.9	777	219	79	8 857
Tertiary heating	1.7	2 111	559	300	20 120
Household transport	-0.1	-56	-16	-6	-659
Transport of goods and services	1.3	428	156	-89	4 701
Total	12.1	6 745	2 022	224	74 935

Impact on employment in terms of Annual Work Units (AWU) takes into account three components:

- direct employment, obtained by multiplying the investment cost vector by the labour requirement coefficients in each directly activated production sector;
- indirect employment, which is dependent on the supply chain of the sectors activated by the investment;
- ancillary employment, which is dependent on the phase of redistributing profits to production factors which, in turn, reactivate the end demand for goods and services.

The table above shows how the impact of additional investment envisaged in the INECP scenario is greater than the impact of the counterfactual scenario in terms of employment, increase in value added and increase in direct tax revenue.

In some cases, for example the measures in the residential sector or the purchasing of cars, net indirect taxation is slightly negative (since, in the intervention scenario, the sectors that are mostly activated are those that receive support or that have lower VAT rates than those in the counterfactual scenario).

Overall, all the measures assessed (€11.6 billion/year of investment) could have a positive net impact: €6.7 billion/year extra value added, an increase in employment levels of almost 75,000 work units/year in the course of the period in question, and an increase in revenue of around €2.2 billion/year⁴⁹.

⁴⁹ Indirect taxation (VAT net of production levies) is calculated by applying the SAM; direct taxation, on the other hand, is obtained by applying an average personal income tax rate to revenue from induced employment income and an average corporate income tax rate to revenue from capital/company income. The variation in revenue is the result of the higher tax revenue from the productive sectors activated in the INECP scenario compared with the counterfactual scenario.

Analysis according to the GTAP-GDynE model

Having seen the impact of the measures envisaged in the INECP scenario within the national borders, the macroeconomic impact in a transnational competitive context must be analysed for the same period; this impact is calculated as the difference between the INECP scenario and the current policies scenario.

For this purpose, recourse was made to a general economic equilibrium model and a modified version of the GDyn-E (Golub 2013) computational model was used; this is a dynamic and recursive variant of the GTAP (Hertel 2017) model, including the electricity produced by renewable sources (Peters, 2016).

The model represents the global economy on a multi-regional and multi-sectoral scale thanks to the GTAP v.9 database. Companies and households are included as representative agents, and the sectoral goods and those from productive factors are modelled. The main assumptions made in the model are: assumption of perfect competition, constant economies of scale and full employment.

In total, the model includes 31 sectors, of which 16 are energy sectors, including fossil fuels and energy produced by fossil and renewable sources, distinguishing the baseline and peak demand. As regards the productive sectors, the model includes the sectors: agriculture, services, industry (subdivided into new manufacturing branches and construction), and transport, subdivided into air, maritime and land. 17 countries and macroregions are represented, including seven EU countries in addition to Italy, three OECD member countries and eight countries from the rest of the world. This version of the GDyn-E model enabled an evaluation to be performed of the macroeconomic impact of the INECP scenario on Italy, with the focus on GDP, sectoral value added and international competitiveness. Although decarbonisation may lead to carbon leakage phenomena, no adjustments to the tariffs or support measures aimed at safeguarding competitiveness in the national industrial sectors have been introduced into the model.

Harmonising the GDyn-E model with the TIMES model, which is used to produce the energy scenarios for the INECP, firstly involved introducing uniform assumptions into the current policies scenario: the growth rates assumed for CO₂ emissions, GDP, population, workforce and international prices of fossil sources are similar to those introduced in the TIMES model, in line with the trends in the European Commission's base scenario (EUref2016). Given that GDyn-E is a global model, the results obtained from the application thereof are greatly dependent upon the assumptions made in the other Countries and Regions taken into account in the analysis. The assumptions contained in the EUref2016 scenario have been used for GDP, population, workforce and emissions from EU Countries, while reference was made to projections by World Bank, International Labour Organization and IEA (ETP 2017 Reference Scenario) for all the other Countries.

The joint use of the GDyn-E with the TIMES Italia model predicts alignment of the emissive part: the energy scenario is therefore used as input provider for GDyn-E both in the current policies scenario and in the INECP scenario. The emissions pathway in the INECP scenario was therefore replicated in GDyn-E. For the other EU countries, emission reduction pathways like the ones in the EUCO30+35 (E3MLab & IIASA, 2016) scenario have been assumed, while pathways like the ones in the IEA ETP 2017 New Policy Scenario (2SD) have been assumed for the rest of the world. Attempts have therefore been made to simulate an international

framework in which each Country contributes to decarbonisation in its own energy system. In Italy's case, the joined use of the two models also sees use of primary and final energy consumption as control variables, seeking to align the results of the GDyn-E with the values provided by TIMES to the greatest extent possible. As regards specific measures, the phase-out of coal in electricity generation, an increase in LNG and electrification in the transport sector and the retention of manufacturability in the hydroelectric sector was also simulated in GDyn-E.

The results from the GDyn-E model show a modest impact on GDP induced by the INECP scenario. Up until 2025, average annual growth rates in the five-year period simulated are, in fact, in line in the two scenarios, while in the five-year period between 2025 and 2030, there would be a lesser increase in GDP in the INECP scenario than in the current policies scenario (1.3% vs 1.48%). It should be noted that the energy intensity of the GDP, calculated as primary consumption/GDP, would halve in the INECP scenario in 2030 compared with 2011, reducing by 18% compared with the current policies scenario in the same year, and encouraging a decoupling of economic growth from energy consumption and emissions.

The INECP scenario does not show a great impact on the sectoral added value, which would continue to grow compared with 2011 in more than half the sectors in question, with rates only slightly lower than the current policies scenario. In particular, an expansion is evident in the chemical and petrochemical, engineering and non-ferrous metals sectors compared with a decline in the steel and non-metallic mineral sector (construction materials). In 2030, both scenarios show a decline can be seen in the industrial sector, with its total contribution reducing from 25% in 2011 to a value of 22%, and an increase in the services sector (from 71% in 2011 to 74%). The same phenomenon can be seen when it comes to redistribution of sectoral employment. Similarly to that observed for GDP, the INECP scenario would mean a general reduction compared with the current policies scenario as regards sectoral energy intensity too (calculated as final/consumption/value added), as well as a reduction in the share of energy expenditure in sectoral production expenditure.

In terms of international trade, in the first instance a reduction in energy imports can be seen, particularly in the INECP scenario, where, in 2030, imports decline by 14% in physical terms and by 13% in value compared with the current policies scenario. Energy dependence therefore also sees a reduction compared with the 2011 value and compared with the current policies scenario, in line with the INECP energy scenario. Imports reduce in almost all the industrial sectors in question, with the exception of steel and non-metallic minerals. These two sectors also see a decline in exports, in line with what has been observed in terms of sectoral value added. Exports, however, are increasing in all the industrial sectors analysed, at higher rates in Italy's leading export sector, engineering, and in textiles.

The trends described up to this point show an overall improvement in international competitiveness in the manufacturing sector, as demonstrated by the trade balance of payments in the sector, which is expanding in the papermaking, food, engineering and textile sectors. Looking at Italy's ranking in its main export sectors, the INECP scenario does not have any impact compared with the current policies scenario; our country's position is not altered compared with its main trading partners. As regards the bilateral trade balance, a general improvement can be seen compared with Italy's main trading partners, with a decline in imports (-1% from China, -9% from Russia and -9% from OPEC countries) and an increase in primary exports to other European countries.

Social impacts of coal phase-out

The evaluations previously described, carried out using the standard input/output model (GSE data), show that in 2017 there were an estimated 3,800 plus direct and indirect working units (full-time equivalent) employed for electricity generation from coal-fired power plants. There are currently 8 coal-fired thermal power plants in Italy, generally located in major industrial areas:

- Fiumesanto (SS) power plant: two 320 MW coal sections.
- Monfalcone (GO) power plant: two 165 and 171 MW coal-fired sections.
- Torrevaldaliga nord (RM) power plant: three 660 MW sections converted to coal.
- Brescia power plant: one 70 MW coal-fired section.
- Brindisi sud power plant: four 660 MW coal-fired units.
- Sulcis (CA) power plant: one 340 MW coal-fired unit.
- Fusina (VE) power plant: four 320 MW coal-fired units.
- La Spezia power plant: one 600 MW coal-fired unit.

Figure 72 – National coal-fired thermal power generation plants [Source: Assocarboni]



With a view to ensuring a fair energy transition, the coal phase-out will be accompanied by employee protection measures ensuring their employment development and retraining, and measures to combat poverty and inequality and to safeguard their local areas.

To address these challenges, action is being taken on several fronts:

- regulatory, through laws to protect workers affected by the coal phase-out;
- institutional, by strengthening dialogue between national and local institutions and between institutions and workers' representatives;
- business-related, through the involvement of employers and workers in retraining projects, including those supported by public policies.

In regulatory terms, Decree-Law No 101 of 3 September 2019 established that from 2020 to 2024 the amount exceeding €1,000 million of the proceeds from the auctions for the allocation

of EU ETS quotas, for a maximum of €20 million per year, will be channelled to the ‘Fund for vocational retraining in areas in which coal-fired power plants are located’. The fund will be set up at the Ministry of Economic Development.

From an institutional perspective, the assessment of any infrastructural changes necessary for the concrete implementation of the phase-out of coal-fired electricity production will be based on a comparison in specific sectoral working groups organised by the Ministry of Economic Development (for electricity market zones and with a specific one for Sardinia). These will include operators, local authorities, Terna and the social partners. The purpose of the working groups is to assess the technical and regulatory conditions, the necessary infrastructure and how best to safeguard jobs. With a view to a fair energy transition, with the coordination of GSE and in collaboration with the above-mentioned working groups, the following will be monitored: the socio-economic effects, and employment and income distribution in particular; and the INECP measures, with the focus on industrial and carbon-intensive Regions particularly affected by decarbonisation policies.

Lastly, an interesting project integrating private and public policies and dialogue between employers and the other social partners has been implemented by Enel S.p.A. (former sole national operator for electricity generation, transformation, transmission and distribution activities). This is the ‘Futur – E’ project, which involves the decommissioning of 23 old thermoelectric power plants that are no longer economically viable or environmentally sustainable and have a capacity of 13 GW, including some coal-fired plants. The project involves:

- the retraining and redeployment of surplus workers through agreements and negotiations, after discussions between the company, workers and their representatives and the integration of company and public policies;
- the conversion and redevelopment of disused sites with a due regard for safeguarding ancillary industries.

12 of the 23 thermal power plants involved in the project have a conversion plan in place so far, with ideas ranging from the reuse of facilities for tourism/accommodation, biotechnology hubs, multipurpose centres, promotion of local food and wine, logistics centres, etc.

Possible impacts on employment, education and skills including fair transition aspects

The National Institute for Public Policy Analysis (INAPP) on behalf of the Ministry of Labour and Social Policy has created an information system on professions, employment and professional needs that links the productive/economic system and the professional education and training system. This information tool is designed to read the data over two time frames: short-term employment forecasts and currently required occupational skills; medium-term employment forecasts and five-year anticipation of required occupational skills. Using this, in 2019 INAPP analysed future needs⁵⁰ in the electricity, gas, water and steam supply sector (ATECO 35), in the light of today's institutional and regulatory approaches, with particular reference to the INECP. The aim of the analysis, carried out with the help of a specially formed expert group⁵¹ is to:

- identify the occupations that will be most affected and undergo the greatest transformation over the next five years;
- identify new and innovative skills and competences;
- update and implement the occupational database managed by the INAPP;
- produce suggestions on innovations/insertions to curricula to enable workers to adapt to change.

⁵⁰ This is a study to anticipate required occupational skills using scenario methodologies as part of the National Operational Plan for Active Employment Policy Systems (PON SPAO), ESF Programming Period 2013-2020

⁵¹ The following were invited to participate in the expert group: Ministry of Economic Development, GSE, trade unions, companies and trade associations in the sector.

The following steps were necessary for the above analysis:

- statistical definition of the sector and mapping of products/services and production processes for the current scenario and analysis of the main economic and employment trends;
- identification of important trends and drivers in the near future and their combination with the key factors of change;
- in relation to these changes, identification of changes in occupational roles and tasks;
- recognition and assessment of emerging occupational skills in relation to changes in roles and tasks;
- analysis of the impact and implications of these changes for workers in the sector;
- outline and illustration of the changes in job profiles.

The sector studied comes under Section D ‘Supply of electricity, gas, steam and air conditioning’ of the ATECO 2007 classification. It is fully encompassed by division 35, which includes all activities ranging from the generation to the supply, transmission and marketing of electricity, natural gas, steam and air conditioning (hot or cold). An analysis of the latest ISTAT data available when the study was made (2017) shows that this is a capital intensive sector, where a turnover of over €168 billion is achieved with a workforce of around 88,000. Companies with over 250 employees account for 69% of the workforce, compared with 23% of the industry as a whole.

There is a marked diversity in the electricity sector between a small core of very large companies (1.4% of the total, alone employing 70.1% of the workforce) and a large number of small operators active mainly in the renewable energy field (95.5% of companies with fewer than 49 employees accounting for just under 20% of employment). The gas sector, on the other hand, is much less polarised, with 2.2% of the companies with more than 250 employees employing 50% of the workforce. The remaining workforce is distributed between smaller companies of up to 49 employees (24.5% of the workforce and 88% of companies) and medium-sized companies of between 50 and 249 employees (25% of workers and 10% of companies). Other interesting features of the sector include:

- the prevalent use of ‘standard’ work, i.e. full-time work of open-ended duration;
- specialisation, on average, at a higher qualification level than in industry as a whole;
- strong imbalance towards male workers (almost 81% in electricity and 76% in gas);
- limited presence of foreign workers, with 3.4% in the electricity sector and 2.6% in the gas sector, compared with 12% in the Italian industrial system as a whole;
- generational composition of the workforce, where there is a very high proportion of workers over 50 years of age: 45% in the electricity sector and 49% in the gas sector.

Factors of change potentially having a significant impact in terms of demand for skills and occupations were then identified:

- climate change and increasingly extreme weather events;
- energy transition: decarbonisation, renewables and energy efficiency;
- switch from a multi-vector supply system to a predominantly single-vector one based on electricity;
- ongoing research and new digital technologies;
- liberalisation and growing competitiveness not only for the energy produced but also for a series of secondary services and quality factors such as traceability, eco-sustainability, respect for the land and local area, and corporate social responsibility;
- growing importance of marketing and development of online sales activities;
- redistribution of energy production and increasing importance of each local area as a place where local authorities and communities work together;

- global population growth and resulting growth in consumption.

On the basis of the factors listed above, the most significant changes in the typical occupations in the sector have been assumed and the skills associated with them identified. Key among these are the ability to:

1. develop approaches based on self-diagnosis, self-correction and continuous improvement;
2. take decisions for tasks that are within worker's remit and which support their professional autonomy;
3. promote and participate effectively in interactions between different links in the chain of responsibility and collaborate vertically and horizontally;
4. manage change processes in company's organisational structure with a view to increasingly enhancing and building on human capital;
5. understand customers' needs for the development of products and services;
6. oversee the distribution strategy for purchasing and selling products and services;
7. effectively communicate relevant information about processes, products, services and solutions;
8. identify and oversee logistical processes, both internally and externally, for distribution of the product/service from the production location to the end customer;
9. positively interact within intercultural and multidisciplinary contexts;
10. make decisions regarding worker's own context by acquiring relevant information in a timely manner;
11. promote risk analysis within business processes;
12. constantly transfer innovative know-how within production, organisational and research processes;
13. interpret and apply general and specific regulations in relation to the local, national (and international) business/organisational system;
14. select the most appropriate technologies in the management and development of company production processes;
15. use information systems and web-based communication tools in the ordinary management of business processes

The competences listed above have been cross-referenced with the workers and occupations most closely involved in the energy transition scenario. The occupations are set out below.

Table 76: List of selected occupations:

Nomenclature and classification of occupations selected (ISTAT)	Description of selected occupations
1.2.1.2.0	Entrepreneurs and directors of large companies operating in mineral extraction, manufacturing, production and distribution of electricity, gas and water, and waste management
1.3.1.2.0	Entrepreneurs and managers of small companies operating in mineral extraction, manufacturing, production and distribution of electricity, gas and water, and waste management activities (producers and distributors)
2.2.1.1.1	Mechanical engineers
2.2.1.1.4	Energy and nuclear engineers
2.2.1.3.0	Electrical and industrial automation engineers
2.2.1.4.1	Electronics engineers
2.2.1.6.1	Environmental engineers
2.5.1.5.1	Specialists in goods and services acquisition
2.5.1.5.2	Specialists in goods and services marketing (excluding ICT sector)
3.1.3.3.0	Electrical technicians
3.1.3.6.0	Energy saving and renewable energy technicians
3.1.4.2.1	Thermal and electricity production technicians
3.1.4.2.3	Technicians specialising in the operation of electricity distribution networks
3.1.8.3.1	Environmental monitoring technicians
6.2.4.1.1	Installers and repairers of electrical Industrial systems
6.2.4.1.4	Installers and repairers of electricity production and conservation equipment

In addition, the study shows that the energy transition will lead to the increasing involvement of statisticians, mathematicians and meteorologists. These are 'data scientists' who contribute to the creation of new tasks and duties in the energy sector, in which the development and application of Industry 4.0 enabling technologies (Internet of Things, artificial intelligence, big data, robotics, etc.) will be relevant and significant than in other sectors. This requires professionals who are able to analyse the huge amounts of relevant data needed for activities and production processes.

The following table shows the importance a certain skill may have, in the future, within the specific occupations selected, according to the following criteria

- high importance level (red): the individual must possess these skills in depth to deal with changes in professional tasks and targets required by the profession;
- medium importance level (green): the individual must have a basic grasp of the skills to deal with the changes in tasks related to the occupation and targets required by the profession. Their acquisition and complete mastery may come later, but are necessary;
- sufficient importance level (yellow): the individual must have a basic grasp of the professional skills to deal with the changes in occupation-related tasks and targets required by the profession, especially for a better understanding and possibility of interaction inside and outside the workplace;
- low importance level (white) it was considered that this type of skill was not sufficiently relevant for the specific profession.

Table 77: Cross between competences identified and occupations selected

Competences identified	Very important	Important	Low importance	Unimportant	Selected occupations																
					1.2.1.2.0	1.3.1.2.0	ZZM	2.2.1.6.1	2.5.1.5.1	2.5.1.5.2	3.1.3.3.0	3.1.3.6.0	3.1.4.2.1	3.1.4.2.3	3.1.8.3.1	6.2.4.1.1					
Ability to develop self-diagnosis, self-correction and continuous improvement																					
Ability to take decisions for tasks that are within worker's remit and which support their professional autonomy																					
Ability to promote and participate effectively in interactions between different links in the chain of responsibility and collaborate vertically and horizontally																					
Ability to manage change processes in company's organisational structure with a view to increasingly enhancing and building on human capital																					
Ability to understand customers' needs for the development of products and services																					
Ability to oversee the strategy for purchasing and selling products and services																					
Ability to effectively communicate relevant information about processes, products, services and solutions																					
Ability to make decisions regarding worker's own context by acquiring relevant information in a timely manner																					
Ability to identify and oversee logistical processes, both internally and externally, for distribution of the product/service from the production location to the end customer																					
Ability to positively interact within intercultural and multidisciplinary contexts																					
Ability to promote risk analysis within business processes																					
Ability to constantly transfer innovative know-how within production, organisational and																					
Ability to interpret and apply general and specific regulations in relation to the local, national (and international) business/organisational system																					
Ability to select the most appropriate technologies in the management and development of company production processes																					
Ability to use information systems and web-based communication tools in the ordinary management of business processes																					

Finally, the study shows that Italian vocational education and training (VET) only partially caters to the demand for future skills, while the demand for new skills appears to be very high. The identification of future needs for clusters of skills highlights how the greatest demand, as was to be expected, is for technological and digital as well as transversal skills. These are followed by skills related to marketing, various specialisations, management, and plant operation and maintenance.

The current VET options do not yet seem to adequately include these new skill sets in education and training programmes. The survey of VET providers highlighted the poor training offering for the most important occupations for the future, underlining the gap between what is already available and what is necessary for a balanced development of the sector.

5.3 Overview of investment needs

i. Existing investment flows and forward investment assumptions with regard to planned policies and measures

Achievement of the Energy and Climate Plan's decarbonisation objectives (INECP scenario) requires significant commitment in terms of additional investment compared with the current policies scenario.

As regards the national energy system as a whole, it is estimated that, between 2017 and 2030, more than €180 billion in cumulative additional investment will be needed compared with the current policies scenario (equivalent to an 18% increase in the period in question). These investments would be directed towards special technology solutions and innovation, which are expected to have an impact both on processing and energy supply and on end use. Significant additional investment is needed for the development of renewable sources: it is estimated that in the photovoltaic sector alone additional investment of around €27.5 billion will be needed in the period 2017 – 2030 in order to achieve the INECP scenario targets compared with that envisaged in the current policies scenario.

Table 78 – Investment in the technologies, processes and infrastructure needed for the development of the energy system⁵² [Source: RSE]

Sector	Development under current policies	Investments for the INECP	Delta [€ billion]
	Accumulated costs (2017 - 2030) [€ billion]	Accumulated costs (2017 - 2030) [€ billion]	
Residential	117	180	63
Tertiary	55	90	35
Industry	27	33	6
District heating (distribution only)	1	2	1
Transport (vehicles only)	732	759	27
Electrical sector (power plants)	47	85	38
Electrical system (networks, storage)	30	46	16
Total	1,008	1,194	186

As regards the electrical system, however, measures are envisaged to ensure authorisation of the development of non-programmable renewable sources provided for in the INECP scenario with investments in the 2017-2030 period of no less than €46 billion (+€16 billion compared with the current policies scenario): €26 billion for measures on the distribution network, at least €10 billion for development of the national transmission network and more than €10 billion to create new storage systems on the networks (pumps and batteries). It is estimated that a further €3.7 billion should be added to these investments for the circulation

⁵² The investments are accounted for in the energy scenarios created using the TIMES model by RSE.

of batteries that are directly linked to renewable energy source plants (investments incurred directly from producers and self-producers).

Table 79 – Investment needed to update the electrical system [Source: RSE]

Sector	Investment item	Investments accumulated 2017 -30 [€ million]
Distribution network (MV/LV)	Main stations	2,250
	Secondary substations	4,100
	MV+LV lines	9,850
	Remote control	650
	Other (including metering and resilience)	8,850
	Total distribution	25,700
National Transmission Grid development (HV)	Development plan 2017	7,800
	Defence plan	700
	Additional investment needed to achieve the 2030 targets: upgrading of at least 1000 MW of transmission capacity on the Adriatic coast (included in the Development Plan 2018)	2,000
	Total National Transmission Grid	10,500
	TOTAL	36,200
<i>Other investments being evaluated</i>	<i>Cable HVDC Sardinia-Sicily-South (Proposed in the Development Plan 2018)</i>	2,600

ii. Sector or market risk factors or barriers in the national or regional context

iii. Analysis of additional public finance support or resources to fill gaps identified under point ii)

5.4 Impact of planned policies and measures described in section 3 on other Member States and regional cooperation at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

i. Impact on the energy system in neighbouring and other Member States in the region to the extent possible

Regional cooperation will help identify areas of collaboration in both technological areas and the exchange of best practices that will lead to the creation of important new synergies in the different areas of collaboration with other Member States.

In terms of infrastructure, the launch of the electricity interconnection between Italy and Montenegro will lead to a greater integration of their respective markets, with impacts on the security and sustainability of energy supplies.

In addition, the topics identified as providing potential for regional collaborations could in effect give rise to joint projects.

ii. Impact on energy prices, utilities and energy market integration

The impact of regional cooperation initiatives on energy prices is expected to lead to an initial stabilisation of prices, which should subsequently fall and align more closely with European levels. As far as utilities are concerned, the consequences of increased cooperation should mainly take the form of an improvement in the environmental quality of transport, and consequently of the air. Energy market integration will benefit significantly from new interconnections and the improvement of existing ones, and from increased market coupling with neighbouring countries, leading towards a convergence of energy mixes.

iii. Where relevant, impact on regional cooperation

PART 2 – List of parameters and variables to be reported in Section B of National Plans^{53 54} 55 56

Section B of the Plan, the ‘Analytical Basis’, was drawn up using most of the following parameters, variables, energy balances and indicators. Part of these variables and indicators are specifically set out in Section B of the Plan.

1 General parameters and variables

- 1) Population [million]
- 2) GDP [€ million]
- 3) Sectoral gross value added (incl. main industrial, construction, services, and agriculture sectors) [€ million]
- 4) Number of households [thousands]
- 5) Household size [inhabitants/households]
- 6) Disposable income of households [€]
- 7) Number of passenger-kilometres: all modes, i.e. split between road (cars and buses separated if possible), rail, aviation and domestic navigation (when relevant) [millions of passengers/km]
- 8) Tonnes-kilometres for goods transport: all modes excluding international maritime, i.e. split between road, rail, aviation, domestic navigation (inland waterways and national maritime) [million t/km]
- 9) International oil, gas and coal fuel import prices [€/GJ or €/toe] based on the Commission's recommendations
- 10) EU-ETS carbon price [€/EUA] based on the Commission's recommendations
- 11) Exchange rates of euro and of US Dollar (if applicable) assumptions [€/currency and \$/currency]
- 12) Number of Heating Degree Days (HDD)
- 13) Number of Cooling Degree Days (CDD)
- 14) Technology cost assumptions used in modelling for main relevant technologies

⁵³ For the plan covering the period from 2021 to 2030: for each parameter/variable in the list, trends over the years 2005-2040 (2005-2050 where appropriate) including for the year 2030 in five year intervals shall be reported both in section 4 and 5 State the parameters based on exogenous assumptions or on modelling output.

⁵⁴As far as possible, reported data and projections shall build on and be consistent with Eurostat data and methodology used for reporting European statistics in the relevant sectoral law, as European statistics are the primary source of statistical data used for reporting and monitoring, in accordance with Regulation (EC) No 223/2009 on European statistics.

⁵⁵ NB: all projections are to be performed on the basis of constant prices (2016 prices used as baseline year)

⁵⁶ The Commission will provide recommendations for key parameters for projections, at least covering oil, gas and coal import prices as well as EU ETS carbon

Table 80: General parameters and variables

General parameters and variables	Unit	2005	2010	2015	2020	2025	2030	2035	2040
Population	million	57.9	59.2	60.8	61.2	62.2	63.3	64.4	65.4
GDP	€ million (2010)	1 629 932	1 604 515	1 557 180	1 666 404	1 766 986	1 874 834	2 019 407	2 182 555
Gross value added by sector									
Agriculture	€ million (2010)	28 574	28 417	29 221	28 673	29 464	29 973	30 632	31 395
Construction	€ million (2010)	92 122	81 207	63 627	67 443	70 621	75 028	81 704	89 549
Services	€ million (2010)	1 053 895	1 063 043	1 055 278	1 125 810	1 203 401	1 284 487	1 392 898	1 513 262
Energy sector	€ million (2010)	27 462	25 238	19 745	19 656	20 228	21 161	22 058	23 415
Industry	€ million (2010)	262 986	245 341	243 809	268 194	276 476	286 360	299 515	315 670
Number of households	million	23.6	24.5	25.9	26.3	27.0	27.7	28.4	29.2
Household size	inhabitants/hous	2.5	2.4	2.3	2.3	2.3	2.3	2.3	2.2
Number of passengers-km	million pkm	934 705	959 227	939 935	996 913	1 011 175	1 044 145	1 066 586	1 086 495
Public road transport	million pkm	101 454	109 322	102 605	105 080	107 022	108 901	112 051	112 281
Private cars	million pkm	680 000	698 390	676 350	717 501	714 012	724 982	730 551	736 163
Motorcycles	million pkm	49 212	41 480	41 300	40 966	41 442	42 321	44,314	46 401
Rail transport	million pkm	56 400	54 300	58 900	64 919	73 433	87 268	91 549	96 040
Aircraft	million pkm	42 655	50 904	55 919	63 446	70 138	75 439	82 748	90 020
Domestic navigation	million pkm	4 983	4 831	4 861	5 001	5 127	5 234	5 373	5 590
Number of tonnes-km	million tkm	269 484	268 341	218 909	235 774	249 073	262 740	274 132	282 832
Road	million tkm	192 400	201 593	150 237	160 580	169 946	179 773	187 361	190 715
Rail	million tkm	22 761	18 600	20 781	24 506	26 136	27 701	29 112	31 241
Domestic navigation	million tkm	54 323	48 148	47 891	50 687	52 991	55 266	57 659	60 877
International fuel prices									
Oil	€2013/GJ			7.5	11.6	13.2	14.5	15.1	16.0
Gas (GCV)	€2013/GJ			6.0	7.5	8.1	8.8	9.4	9.7
Coal	€2013/GJ			1.8	2.2	2.6	3.2	3.4	3.5
CO₂ price – ETS sector	€2016/tCO ₂			7.8	15.5	23.3	34.7	43.5	51.7
Dollar/euro exchange	\$/€	1.2	1.3	1.1	1.2	1.2	1.2	1.2	1.2
Heating Degree Days (HDD)		2 051	1 992	1 818	1 802	1 787	1 775	1 763	1 753
Cooling Degree Days (CDD)		519	534	569	583	597	611	623	636

2 Energy balances and indicators

2.1 Energy supply

- 1) Indigenous production by fuel type (all energy products that are produced in significant quantities) [ktoe]
- 2) Net imports by fuel type (including electricity and split into intra- and extra-EU net imports) [ktoe]
- 3) Import dependency from third countries [%]
- 4) Main import sources (countries) for main energy carriers (including gas and electricity)
- 5) Gross inland consumption by fuel type source (including solids, all energy products:

coal, crude oil and petroleum products, natural gas, nuclear energy, electricity, derived heat, renewables, waste) [ktoe]

2.2 Electricity and heat

- 1) Gross electricity generation [GWh]
- 2) Gross electricity generation by fuel (all energy products) [GWh]
- 3) Share of combined heat and power generation in total electricity and heat generation [%]
- 4) Electricity generation capacity by source, including retirements and new investment [MW]
- 5) Heat generation from thermal power generation
- 6) Heat generation from combined heat and power plants, including industrial waste heat plants
- 7) Cross-border interconnection capacities for gas and electricity [definition for electricity in line with outcome of ongoing discussions on the basis of 15% interconnection target] and their projected usage rates

2.3 Transformation sector

- 1) Fuel inputs to thermal power generation (including solids, oil, gas) [ktoe]
- 2) Fuel inputs to other conversion processes [ktoe]

2.4 Energy consumption

- 1) Primary and final energy consumption [ktoe]
- 2) Final energy consumption by sector (including industry, residential, tertiary, agriculture and transport (including split between passenger and freight transport, when available)) [ktoe]
- 3) Final energy consumption by fuel (all energy products) [ktoe]
- 4) Final non-energy consumption [ktoe]
- 5) Primary energy intensity of the overall economy (primary energy consumption per GDP [toe/€])
- 6) Final energy intensity by sector (including industry, residential, tertiary and transport (including split between passenger and freight transport, when available))

2.5 Prices

- 1) Electricity prices by type of using sector (residential, industry, tertiary)
- 2) National retail fuel prices (including taxes, per source and sector) [€/ktoe]

2.6 Investment

Investment costs in energy transformation, supply, transmission and distribution sectors.

2.7 Renewable energy

- 1) Gross final consumption of energy from renewable sources and share of renewable

energy in gross final energy consumption and by sector (electricity, heating and cooling, transport) and by technology

2) Cogeneration of heat and electricity from renewable energies in buildings; includes, where available, disaggregated data on the energy produced, consumed and fed into the grid by photovoltaic solar systems, thermal solar systems, biomass, heat pumps, geothermal systems as well as all the other decentralised renewable energy systems.

3) If applicable, other national trajectories, including long term or sectoral ones (the share of food-based and advanced biofuels, the share of renewable energy in district heating, as well as the renewable energy produced by cities and energy communities as defined by Article 22 of [recast of Directive 2009/28/EC as proposed by COM(2016) 767])

3 GHG emissions and removals related indicators

- 1) GHG emissions by policy sector (EU ETS, effort sharing and LULUCF)
- 2) GHG emissions by IPCC sector and by gas (where relevant, split into EU ETS and effort sharing sectors) [tCO₂eq]
- 3) Carbon intensity of the overall economy [tCO₂eq/GDP]
- 4) CO₂ emission-related indicators
 - a) GHG intensity of domestic electrical power and heat generation [tCO₂eq/MWh]
 - b) GHG intensity of final energy consumption by sector [tCO₂eq/toe]
- 5) Non-CO₂emission-related parameters
 - a) Livestock: dairy cattle [1000 heads], non-dairy cattle [1000 heads], sheep [1000 heads], pig [1000 heads], poultry [1000 heads]
 - b) Nitrogen input from the use of synthetic fertilisers [kt nitrogen]
 - c) Nitrogen input from the use of manure [kt nitrogen]
 - d) Nitrogen fixed by N-fixing crops [kt nitrogen]
 - e) Nitrogen in crop residues returned to soils [kt nitrogen]
 - f) Area of cultivated organic soils [hectares]
 - g) Municipal solid waste (MSW) generation
 - h) Municipal solid waste (MSW) going to landfills
 - i) Share of CH₄ recovery in total CH₄ generation from landfills [%]