PORTUGAL

NATIONAL ENERGY AND CLIMATE PLAN 2021-2030 (NECP 2030)

Portugal, December 2019

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1. OVERVIEW AND PROCESS FOR ESTABLISHING THE PLAN

1.1. Summary

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

The Paris Agreement (PA) signed in 2015 established long-term objectives to contain the rise in the average global temperature to a maximum of 2°C above pre-industrial levels. The international community made the commitment to make every effort to ensure that this rise in temperature would not exceed 1.5°C, which science has defined as the maximum increase for life on the planet to continue without excessive disruption. It also set out objectives to increase the capacity to adapt to the adverse impacts of climate change and to mobilise financial resources in a manner consistent with low-emission trajectories and resilient development.

This Agreement thus represented a paradigm shift in the implementation of the United Nations Framework Convention on Climate Change, explicitly recognising that the challenge of climate change can only be overcome if everyone contributes to the effort. The main commitments of this agreement are to achieve a balance on a global level between human emissions and emissions removal during the second half of the century, to prepare and communicate 'Nationally Determined Contributions' (NDC) for the global effort to reduce emissions, which must be progressively more ambitious and to prepare and communicate 'Long-Term Strategies to Reduce Emissions'.

In 2016, during the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), Portugal adopted the target of being carbon neutral by 2050, having developed a Roadmap for Carbon Neutrality 2050 (*Roteiro para a Neutralidade Carbónica* – RCN 2050), which sets out Portugal's vision, trajectories and guidelines for the policies and measures to be implemented within this time frame. The RCN 2050 was published by means of Council of Ministers Resolution No 107/2019 of 1 July 2019 and constituted the long-term development strategy for low greenhouse gas emissions submitted to the UNFCCC on 20 September 2019.

In keeping with the conclusions of the IPCC Special Report on 1.5°C, RCN 2050 also concluded that greater efforts must be made during the 2021-2030 decade to reduce greenhouse gases (GHG), this being an essential decade to align the national economy with a carbon neutral trajectory. Thus, ambitious but attainable goals were established, coordinated with the RCN 2050 objectives for the 2030 horizon. These are set out in the National Energy and Climate Plan, which is the main national climate and energy policy tool for 2021-2030, aiming to achieve a carbon neutral future.

The challenges society faces require concerted action between energy and climate policies, since this is the only possible way to achieve a carbon-neutral economy and a society that both promotes economic growth and better quality of life. To this end, NECP is a fundamental tool to ensure that energy and climate goals for 2030 are achieved and it is a forward-looking plan to implement Portugal's long-term objectives.

It is important to note that Portugal has a prominent position internationally in relation to reducing greenhouse gas emissions and developing sources of renewable energy, having achieved particularly positive results in recent years. In 2017, Portugal recorded a 17.5% reduction in GHG emissions, as compared to 2005. Even though 2005 witnessed exceptional conditions, culminating in a spike in emissions, Portugal has consolidated a trajectory of decarbonising the national economy.

Portugal has striven to attain progressively higher levels of incorporating renewable sources in various sectors, having achieved a total share of incorporation that is significantly higher than the European average, with an upward trajectory in recent years (+8.9 p.p. as compared to 2005). Portugal's progress is equally relevant in the electricity sector and it is currently ranked third in the European Union for countries that have a higher level of incorporating renewable sources (+26.8 p.p. over figures for 2005).

As a result of this evolution, Portugal has managed to reduce its external energy dependence (-9.1 p.p. as compared to 2005), increasing domestic energy generation and reducing the consumption of primary energy (- 17.0% as compared to 2005), thus also ensuring greater supply security.

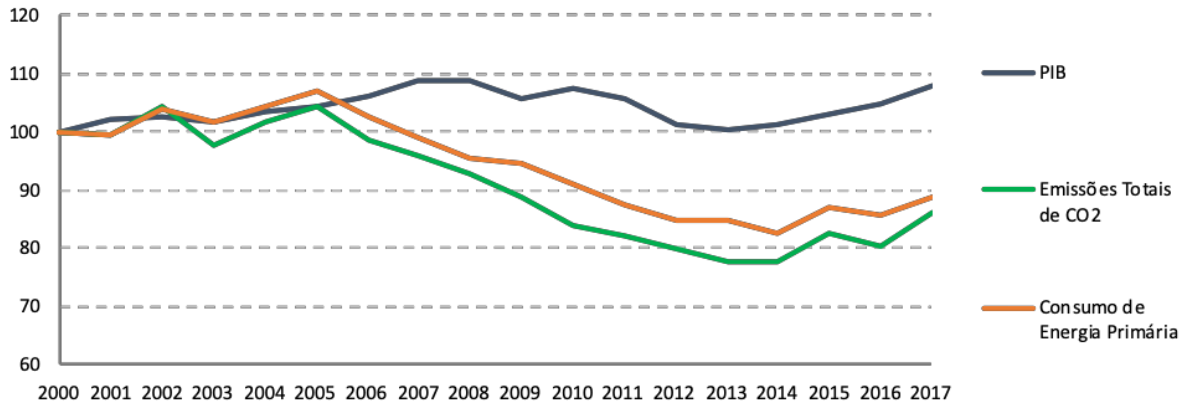
The contribution of this sector to the Portuguese economy should also be noted, having created an entirely new industrial and corporate segment, generating employment, promoting regional development, stimulating the export of goods and services, driving innovation and scientific research which attracts international investment and stimulates the internationalisation of national companies.

Table 1- Evolution in the main energy and climate indicators in Portugal [Source: APA, DGEG]

INDICATOR	2005		2017	VARIATION
TOTAL CO_2 EMISSIONS (without LULUCF)	85.8 Mton	→	70.8 Mton	-17.5%
PRIMARY ENERGY CONSUMPTION	27.1 Mtoe	→	22.5 Mtoe	-17.0%
RENEWABLES IN FINAL CONSUMPTION	19.5%	→	30.6%	+11.1 p.p.
RENEWABLES IN ELECTRICITY	27.4%	→	54.2%	+26.8 p.p.
ENERGY DEPENDENCY	88.8%	→	79.7% | 77.8%[1]	-9.1 p.p. | -11.0 p.p.

It is also important to emphasise Portugal's progress in relation to climate and energy in recent years and how it has been able to decouple GDP from Primary Energy Consumption and CO_2 Emissions. This means that Portugal has managed to generate wealth with lower emissions and lower energy consumption, with clear benefits for the economy and for society. This trajectory is expected to be maintained over the coming decades, as Portugal moves toward an increasingly less intensive carbon and energy economy, based on renewable sources and improvements in energy consumption by adopting more sustainable practices throughout the value chain, optimising processes and production, adopting new low-carbon technologies and promoting greater awareness of the need to pursue this path.

Figure 1 – Evolution in Gross Domestic Product, Total CO2 Emissions and Primary Energy Consumption (2000 = 100) [Source: INE, APA, DGEG]



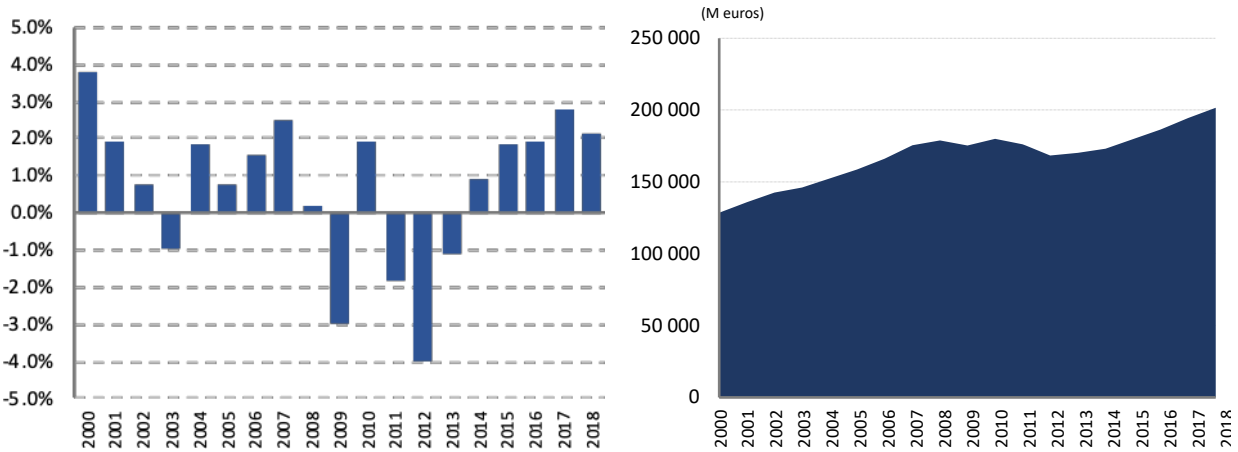
[1] Including the contribution of heat pumps

Key

PT	EN
PIB	GDP
Emissões Totais de CO_2	Total CO_2 emissions
Consumo de Energia Primária	Primary Energy Consumption

Portugal has witnessed an economic recovery in recent years, resulting, among other aspects, in growth in the Gross Domestic Product (GDP). In 2018, GDP increased 2.1% in volume, 0.7 p.p. less than in the previous year, which in nominal terms translates into a 3.6% increase, standing at 201.6 billion euros. Net external demand contributed -0.7 p.p. toward the variation in GDP volume, there being a more accentuated slowdown in Exports of Goods and Services than in Imports of Goods and Services. The positive contribution of domestic demand fell to 2.8 p.p., reflecting the less intense growth of Investments.

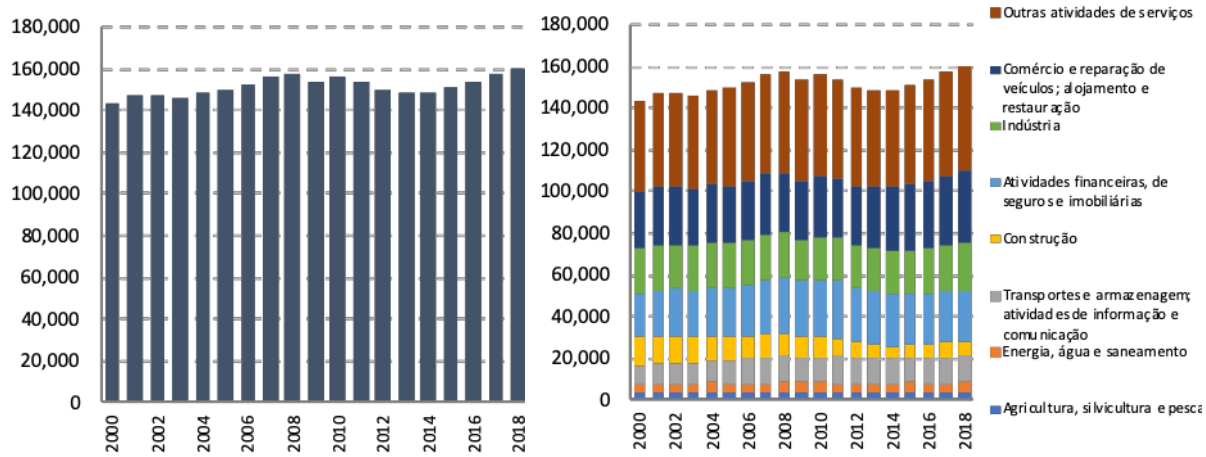
Figure 2 – Variation in GDP in Portugal [Source: INE]



According to recent projections, the growth trajectory is expected to be maintained in coming years, reflecting the progress achieved with respect to the process of converging the national economy.

In relation to production, base price Gross Value Added (GVA) recorded growth of 1.7% as compared to 2017. GVA grew notably in the Transport and Warehousing, Information Activities and Communications sectors, which increased 2.5% in 2018. GVA of the Energy, Water and Sanitation sectors grew 4.9% in real terms as compared to 2017. GVA of the Vehicle Sale and Repair, Accommodation and Restaurants sectors increased 2.9% in real terms while GVA of the Construction sector grew 2.2% in real terms in 2018. GVA of the Financial Activities, Insurance and Real Estate sectors and GVA of Other Service Activities increased 1.2% and 1.3%, respectively, in real terms as compared to 2017. GVA of the Industry sector grew 0.6% in real terms as compared to 2017. On the contrary, there was a reduction, in real terms, of 1.8% of GVA in the Agriculture, Forestry and Fisheries sectors.

Figure 3 – Evolution in Gross Value Added in Portugal (millions of euros, chain-linked data in volume; annual) [Source: INE]



Key

PT	EN
Outras atividades de serviços	Other service activities
Comércio e reparação de veículos; alojamento e restauração	Vehicle sale and repair
Indústria	Industry
Atividades Financeiras de seguros e imobiliárias	Financial insurance and property activity
Construção	Construction
Transportes e armazenagem	Transport and storage
Atividades de informação e comunicação	Information and communication activities
Energia, água e saneamento	Energy, water and sanitation
Agricultura, silvicultura e pescas	Agriculture, forestry and fisheries

In line with this vision and developed in conjunction with RCN 2050, Portugal's Integrated National Energy and Climate Plan (NECP) is framed within the obligations arising from Regulation (EU) No 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action. This plan is a draft version as provided for in Article 9(1) of this Regulation.

NECP, as the main instrument for energy and climate policy for 2021-2030, is organised in accordance with the structure set out in part 1 of Annex I of the aforementioned Regulation. It addresses, in a preliminary manner at this stage, the aspects set out in this structure. NECP includes a description of the current situation in Portugal with respect to energy and climate and covers the five dimensions of the Regulation: decarbonisation, energy efficiency, supply security, the internal energy market and research, innovation and competitiveness. It also defines the national contributions and policies and measures planned to comply with the different general commitments made by the Union, including the reduction of greenhouse gas (GHG) emissions, renewable energies, energy efficiency and interconnections.

1.1.2. The five dimensions of the Energy Union strategy

In 2016, during the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), Portugal adopted the objective of being carbon neutral by 2050, having developed a Roadmap for Carbon Neutrality 2050 (*Roteiro para a Neutralidade Carbónica* – RCN 2050), which sets out Portugal's vision, trajectories and guidelines for the policies and measures to be implemented within this time frame. The RCN 2050 was the long-term development strategy for low GHG emissions submitted to the UNFCCC on 20 September 2019.

In keeping with the conclusions of the IPCC Special Report on 1.5°C, RCN 2050 also concluded that greater efforts were required during the 2021-2030 decade to reduce greenhouse gases, this being an essential decade to align the national economy with a carbon neutral trajectory. Thus, ambitious but attainable goals were established, coordinated with the RCN 2050 objectives for the 2030 horizon. These are set out in NECP, which is the main national climate and energy policy tool for 2021-2030, aiming to achieve a carbon neutral future.

Achieving carbon neutrality in 2050 means gradually abandoning a linear economic model, based on fossil fuels, focusing on an economy that is sustained by renewable resources and uses resources efficiently, implementing circular economy models that enhance the territory and promote territorial cohesion.

National efforts to reduce emissions, set against the broader context of actions at a global level, will also assist in significantly reducing adaptation costs, with clear economic benefits.

Responding to this challenge will be truly transformational with regard to some of the main aspects of life in society, particularly in relation to production and consumption standards, the relationship with production and the use of energy, the way in which cities and living, working and leisure spaces are designed, as well as transport and mobility needs. In addition to being a technological challenge it is also a challenge to be face by society, which will greatly depend on support and adoption by all.

In such a global context, the inevitability of energy transition is recognised given the urgent need with respect to climate change and the need to change the economic model, particularly with regard to fossil fuels. Portugal has clearly committed to energy transition to leverage the country's competitiveness, with a view to reducing

its GHG emissions. In addition to the energy sector, all other sectors of the economy will be required to contribute to achieving these emission reductions, through the guidelines and measures set out in this plan as well as in RCN 2050.

For the 2030 horizon, it is particularly important to define a strategy and objectives to help consolidate this path and which allow a competitive national economy to be consolidated, which is resilient and increasingly low-carbon. Compliance with Portugal's targets and objectives is based on a strategic vision for the 2030 horizon.

Portugal's strategic vision for the 2030 horizon

PROMOTING THE DECARBONISATION OF THE ECONOMY TO ACHIEVE CARBON NEUTRALITY BY 2050, AS AN OPPORTUNITY FOR THE COUNTRY, BASED ON A DEMOCRATIC AND FAIR MODEL OF TERRITORIAL COHESION WHICH EMPHASISES THE CREATION OF WEALTH AND THE EFFICIENT USE OF RESOURCES

Although all sectors of activity contribute toward reducing emissions, the energy sector will contribute the most during the next decade, playing an especially relevant role in energy transition towards a decarbonised society. Portugal's strategy for the 2030 horizon is based on a combination of different policy options and measures as well as technological options, seeking to encounter synergies between the different alternatives. The path to a carbon neutral economy requires joint action in several strategic areas, with priority being placed on energy efficiency, greater diversification of energy sources, an increase in electrification, reinforcement and modernisation of infrastructure, development of interconnections, market stability and investment, reconfiguration and computerisation of the market, incentives for research and innovation, promotion of low-carbon processes, products and services, and improved energy services and informed choice for consumers.

Energy efficiency is vital for complying with the decarbonisation of society and as a response to the need for a competitive economy and a resilient, safer and self-sufficient energy system. Portugal is committed to the principle of 'Energy Efficiency First' in decisions on investment projects in the energy sector, with a view to sustainability and cost effectiveness. Experience shows that the challenge of energy efficiency is the same as, or greater than that of renewable energies.

Both the objectives for energy efficiency as well as those for renewable energies will have to be achieved on a cost-effective basis and jointly with other strategic priorities, such as interconnections, aiming for the real integration of the country into the Energy Union and the need to become carbon neutral. However, the country's supply security must always be ensured.

Energy transition in Portugal will undoubtedly involve the electricity sector. Portugal has enormous potential to develop a highly decarbonised electricity production sector, both through the availability of renewable endogenous resources such as water, wind, sun, biomass and geothermal power, as well as through the fact that it has developed a reliable and secure electricity system which is capable of dealing with the variability brought about by the focus on renewables and which will be the target of important evolution in the next decade. The focus for the electricity production sector for the 2030 horizon mainly involves solar energy and, to a lesser extent, wind energy.

With regard to wind energy, the focus will be mainly on hybridisation, new equipment and repowering, three ways of increasing the production of electricity from renewable sources which minimise costs for the consumer and the environment as they optimise the network investments which have already been made.

In the case of solar energy, particularly photovoltaic solar energy, highly competitive prices for this technology when compared with other conventional solutions combined with an abundance of the resource ensure that this is an energy source that offers many benefits for consumers.

To reinforce renewable installed capacity, particularly for solar photovoltaic generation, Portugal opted for auctions to allocate reception capacity in the network with three main objectives: (i) to confer greater clarity and predictability for the licensing processes to generate energy; (ii) to create a mechanism to allocate capacity that suitably responds to the fact that this is a scarce public resource that needs to be managed as such; (iii) to ensure that for each network point being auctioned the winning bids are projects that contribute most toward reducing the electricity tariffs paid by consumers.

Portugal held the first auction in 2019, specifically for solar photovoltaic energy, with a total of 1 400 MW divided over 24 lots. The outcome of this auction, which ensured the lowest prices in Europe and global minimums that directly translated into effective gains for consumers, made it possible to outline a path where the results provide a glimpse of the multiplier potential of this mechanism in future auctions and its considerable contribution to achieving national objectives in relation to renewable energy.

In the short-term, Portugal's strategy is to launch two new auctions to add injection capacity to the network, resulting in the allocation of at least 2 GW of new renewable capacity, including dispatch capability, building on the success of the auction that was held in 2019.

With an electricity production system which has a strong renewable base, the aim is to promote and reinforce the use of electricity in the different sectors of activity and the economy, with particular emphasis on transport, but also on industry and the residential and services sectors.

Energy transition and decarbonisation are not limited to only technological evolution through the replacement or implementation of new technologies or the use of new forms of energy. Participation by consumers will also play a significant role, where they will be more active as consumers/producers of energy and as agents for changes in behaviour which will have considerable impact. A more informed consumer represents better, more efficient and sustainable choices and a consumer at the centre of decision making is a more active consumer in the transition to a carbon neutral society, who is available to participate in the structural changes required to meet this challenge. With the consumer as an informed and active agent in the market, and with instruments to protect more vulnerable consumers, a further strategic priority for 2030 will be addressed; that of fighting energy poverty and consumer vulnerability.

To promote distributed production and self-consumption of power from renewable sources, a new legal framework was developed, Decree-Law No 162/2019 of 25 October 2019, which: (i) allows and promotes individual self-consumption; (ii) allows and promotes collective self-consumption; (iii) allows the forming of energy communities. The legal establishing of these activities will allow individuals, companies and other public and private entities to produce, consume, share, store and sell energy produced from renewable sources, thus actively participating in energy transition.

This new regime comes about in a context of complementarity, by combining centralised instruments to promote clean energies with decentralised processes which, due to their nature, reinforce social and territorial cohesion while helping reduce inequality. This will be achieved by creating jobs, improving the competitiveness of companies throughout national territory and by combating energy poverty. It will also generate a significant reduction in network and distribution costs, reduce losses and optimise energy production solutions.

For its obvious advantages, but also in relation to the challenges it presents, the promotion of self-consumption of renewable energy, whether individually or collectively or through energy communities, will in the short-term, be accompanied by an information and support programme for implementing self-consumption projects. The aim is to reduce information asymmetries and support companies, municipalities and citizens in the development of such systems. Of special note among the initiatives to be implemented is a support programme for establishing self-consumption in partnership with municipalities, which assists both technically and with a view to obtaining financing.

The vision of an electricity production system which is highly decarbonised, decentralised and computerised, with focus on the consumer/energy producer as an active participant in the system which ensures suitable levels of quality of service and supply security, will not be possible to achieve without new design and strategic guidance which takes all these new variables into account.

Smart networks, management support systems, producer and/or consumer aggregators, bidirectional smart meters, storage systems, local production of energy, active consumers, flexibility in supply/demand, electric vehicles, among other factors, are the variables which need to be considered when building the model for the network of the future. To guarantee real integration of all the variables, regardless of the configuration to be adopted, it is important to form a strategic vision of the national electricity network which will allow national targets and objectives for the 2030 horizon to be met.

In the residential sector, efforts will be made to reinforce the thermal comfort of homes both in terms of heating as well as cooling, with emphasis on insulation solutions and the trend toward electrification in this sector. A continued push for urban rehabilitation will provide the opportunity to incorporate improvements in energy and hydro efficiency, low-carbon materials and sources of renewable energy, contributing toward overcoming energy poverty.

In the service sector, some potential that still exists to increase the electrification of consumption will be explored, while increasing the energy efficiency of installed equipment and the use of renewable energy sources will play a fundamental role.

Also with regard to infrastructure, energy interconnections are essential to the development of the internal energy market, ensuring the supply security, improving the functioning of energy systems, increasing the competition and stability of energy markets, promoting the integration of markets, greater fairness and balance in the definition of energy costs and prices and contributing to compliance with EU energy and climate targets. Regional cooperation is also vitally important and will be reinforced with a view to fostering closer ties among Member-States, especially Spain and France, to monitor and assess interconnection projects that meet the interconnection needs of energy markets and systems.

With a view to transitioning the energy sector, the current infrastructure to receive, store, transport and distribute natural gas will play an important role in allowing the introduction, distribution and consumption of renewable gases, particularly biomethane and hydrogen, in various sectors of the economy, making it possible to incorporate higher levels of renewable sources of energy in final energy consumption.

Particularly worthy of note in this regard is the production and incorporation of renewable gases such as hydrogen and biomethane, as early as the next decade, promoting a more intense substitution of fossil fuels and reducing Portugal's energy dependence. The growing recognition of the importance of renewable gases, particularly hydrogen, is based on the fact that they allow the storage of energy and the preparation of other renewable fuels, contributing toward achieving national targets to incorporate renewable sources in final energy consumption and to decarbonise consumption, with particular emphasis on industry and mobility (especially manufacturing and railways).

Against this backdrop, the Portuguese government is promoting an industrial policy centred on hydrogen and renewable gases, and will define public policies that guide, coordinate and mobilise public and private investment in projects in the production, storage, transportation and consumption of renewable gases in Portugal. This new orientation stems from the fact that Portugal has very favourable conditions for installing an industry to produce green hydrogen, with export potential, wherein the main advantage is the low cost of producing the electricity from renewable sources.

The development of an industry to produce green hydrogen in Portugal has the potential to drive an entirely new economy, coupled with the enormous potential to decarbonise various sectors.

Renewable gases, particularly hydrogen and biomethane, have the potential to play an important role in promoting the decarbonisation of sectors of the economy that currently have few alternative technological options and where electrification in the short and medium-term could result in significant costs. Renewable gases have the potential to substitute fossil fuels in industry (e.g. combustion processes and even as a raw material), the road transport of passengers, railway transport (avoiding the costs of electrifying lines), river transport of passengers and goods. Portugal could thus focus on varied solutions with different technologies and territorial dispersion that create value and decarbonise energy consumption.

The Portuguese government is striving to create the necessary conditions and mechanisms to make it possible to recognise and enhance the value of renewable gases (hydrogen and gases obtained from chemical reactions of hydrogen and biomethane) in the national market, promoting dialogue with investors and market operators so as to find cost-effective solutions to create a true renewable gas economy. The development of an industry to produce green hydrogen in Portugal has the potential to drive an entirely new economy, along with the enormous potential for decarbonisation.

Mechanisms are expected to be implemented in the short-term aimed at: (i) regulating the injection of renewable gases into the national natural gas network; (ii) implementing a guarantee of origin system for renewable gases; (iii) concentrating financial resources available in national and European funds to support energy production through the production of renewable gases, particularly hydrogen and biomethane; (iv) assessing the setting of binding targets by 2030 to incorporate renewable gases into the natural gas network.

Specifically, **the installation of an industrial unit in Sines to produce green hydrogen (1 GW) is currently being studied**, fuelled by solar energy and based on strategic partnerships both nationally as well as on a European level. This includes a strategic partnership with Holland, with the potential to include other Member-States, thus providing a European dimension to the project as a means of ensuring Community funding and finding partners for the consortium.

This industrial-scale project to produce green hydrogen focuses on leveraging solar energy as a factor for competitiveness (the cost of electricity represents the greatest component of the cost of production and Portugal has an enormous competitive advantage when compared to other countries because it has lower electricity generation costs), industrial transformation and the opportunity to increase exports. Portugal has highly favourable conditions for installing this type of industry, namely in Sines, considering the multiple advantages of this site – a strategic location on Portugal's Atlantic coast, availability of a deep water port, transport and storage infrastructure and connections to the natural gas transmission network, an industrial zone with current and future hydrogen consumers and the availability of land.

Industry will play an extremely important role as it is one of the key areas where innovation and the creation of new business models is required. Reinforcement of the potential of the circular economy and 'industry 4.0' will be critical on the road to identifying and creating innovative, efficient and green solutions with close to zero emissions, in the coming 30 years;

Although this is a sector where decarbonisation is expected to occur at a slower pace, it is nonetheless a sector that is highly motivated in relation to matters of resource efficiency. Diverse sector roadmaps are currently underway toward a more decarbonised future for this industry, emphasising a circular economy, through industrial symbioses and the recycling of resources, and it could prove to be a great asset in the 2030 time frame.

This sector will also be strongly influenced by automation and digitalisation, with growing levels of electrification and greater use of biomass in conjunction with other forms of renewable energy, such as solar thermal energy.

The decarbonisation of mobility and transport is especially important in terms of the 2030 horizon, as this is one of the most significant sectors in terms of national GHG emissions. The next decade will see a paradigm shift in this sector. Profound changes are expected with a view to decarbonising the sector, with traditional fossil fuels being gradually replaced by electricity, advanced biofuels and hydrogen, achieving substantial environmental and efficiency gains. The future of mobility is a sustainable, autonomous and shared future. It is a future in which users have greater power to manage their own mobility as a result of increasing digitalisation.

However, the paradigm shift is not just limited to technological innovation. A continued emphasis on public transport, which changes the mobility patterns of the Portuguese and reverses trends witnessed in recent years, is one of the most important measures aimed at decarbonisation and energy efficiency.

Increased demand for passenger mobility will be met both by more public transport, using low-emission vehicles, as well as through the spread of shared transport, with emphasis on the increased use of active modes of transport for short-distance mobility.

By 2030, electric mobility and advanced biofuels will be the most cost-effective tools for decarbonisation in the field of transport, however, other low-carbon mobility alternatives will also be implemented, such as hydrogen-powered vehicles.

The decarbonisation of mobility is also intrinsically linked to the spatial planning models for cities, economic and leisure activities and their implications in terms of mobility needs, as well as implications in terms of collective mobility versus individual mobility. Cities have been active agents in decarbonising the economy and it is of vital importance to make the most of this dynamic to create low-carbon cities.

In the field of goods transport, logistics management will be extremely important, including reverse logistics and the management and optimisation of fleets. By 2030, electric light vehicles to transport goods will play a key role, as will biofuels and hydrogen in the context of heavy vehicles. Railways are an important component for the decarbonisation of the medium and long-haul transport of goods and investment will thus be intensified in this infrastructure, including decarbonisation by electrification and other energy vectors, such as hydrogen, along with the modernisation and expansion of rail systems. Maritime transport will also be decarbonised, emphasising new forms of energy, promoting short-distance transport and maximising connections and the interoperability of railway goods transport with commercial ports.

Changes in behaviour with regard to mobility is another aspect that must not be overlooked, both in relation to mobility decisions as well as the adoption of more efficient behaviours by promoting eco-driving and the use of new technologies to encourage sustainable mobility behaviours.

To complete this decarbonisation strategy, it is also vital to include the waste and wastewater sector, which, even though it currently represents a small percentage in total emissions calculations, is a sector that is expected to undergo substantial changes by 2030. In effect, to comply with the goals set out in the Landfills Directive only a maximum of 10% of urban waste produced will be deposited in landfills by 2035. There will thus also be a paradigm shift in the need to increase recycling and reuse waste, focusing on a more circular economy that generates less waste.

The first priority will thus be to reduce the production of waste, followed by reinforcing the separated collection of urban waste, with emphasis on the biological treatment of bio-waste and the intensive use of solutions to reuse and recycle materials.

It is essential to ensure the rational use of existing water resources and to satisfy the needs of all consumers, including environmental consumers. Unexplored national potential for hydroelectricity production will be assessed by establishing rigorous criteria to select sites to install large new hydroelectric projects, which will help comply with the energy goals that have been established, considering and assessing the environmental, social and economic components in an integrated manner.

Moreover, as energy costs are one of the main components of the operating and exploration costs of water supply and wastewater services, with a direct impact on tariffs, energy management is now one of the main challenges facing entities responsible for managing these services.

Recognising the advantages of an integrated and multidisciplinary approach to system management (hydraulic aspects, water quality, reliability, energy management, operations and maintenance), the government has promoted actions that make it possible to: (i) increase the resilience of public water supply systems, by improving their performance, particularly in relation to reducing water loss; (ii) increase the resilience of wastewater systems, by eliminating unlawful connections, adapting WWTP to extreme climate phenomena and reusing treated wastewater; (iii) increase the resilience of rainwater drainage systems, by eliminating leaks, shutting off water flows during periods of intense rain and reusing rain water; (iv) reducing the energy consumed in water services, by improving energy and hydro efficiency and increasing the level of energy self-sufficiency of WWTP and other facilities.

The agriculture sector will also make an essential contribution toward decarbonising the Portuguese economy. Albeit at a less intense pace than other sectors, changes are expected to be implemented over the next decade that will make it possible to reduce emissions, with emphasis on more sustainable agriculture, by disseminating integrated production practices, along with the expansion of organic agriculture, conservation and precision agriculture, reducing emissions associated with animal effluents and the use of synthetic fertilisers and promoting carbon sinks derived from increased organic matter in soils, namely by promoting biodiverse pastures. This type of agriculture will also improve the efficient use of water, enabling productivity gains and saving water, which is a scarce commodity that must be preserved.

It will also be necessary to investigate new forms of animal diets to obtain improvements in the digestibility of animal feeds, with a consequent positive impact on the reduction of emissions.

It will also be important to rethink the entire food chain, from the choices we make with regard to what to eat, reducing wasted food, how plants and animals are produced for food, pressure on soils and water, but also on sea and fish resources. It is similarly important to showcase and replicate best marketing practices in short agri-food circuits, which reduce energy consumption and polluting emissions due to the reduced need to package, transport and refrigerate products.

In the case of forestry and other land use, suitable agroforestry management is essential to progressively reduce burnt areas, increasing productivity and reinforcing ecosystem services that promote and contribute toward combating desertification and enhance the value of the land, as one of the pillars of territorial cohesion. The potential of carbon sinks, particularly forests, will have to be reinforced and carefully managed during spatial planning. Investment will be required in management practices and models which promote the carbon sink role of forests and increase their resilience to climate change and help minimise the risk of fires and soil degradation.

The path to carbon neutrality is also the path to innovation and knowledge and qualification and training. Research and innovation oriented toward new technologies will play a fundamental and transversal role in overcoming the challenges of decarbonisation and energy transition.

The development of new technologies and the improvement of existing low-carbon technologies requires significant effort in research and innovation which will be achieved by adopting an ambitious and wide-ranging agenda which address all parts of the technological development cycle up to and including the sale of such technologies. To this end, an essential role will be played by national support mechanisms oriented toward technological research and development according to Portugal’s priorities, such as hydrogen, storage solutions,

smart networks, advanced biofuels, deep-sea geothermal energy, concentrated photovoltaic, ocean energy, energy integration, the conversion and storage of energy, low-carbon processes, the circular economy and precision agriculture, among other relevant aspects.

Achieving this objective requires changes to our economy, our territorial model and our society. This is why it is essential that this transition be implemented in a planned manner, involving different sectors of our society and the different regions. It is also necessary to look at the economic and social aspects of this transition, ensuring that it occurs in a fair manner. Different analyses carried out internationally demonstrate that adopting policies for a profound decarbonisation of society has a positive impact on the economy, employment and society. Eurofound has pointed out that in Portugal, decarbonisation policies compatible with the Paris Agreement will lead to an increase of more than 1.1% in GDP and a positive impact of 0.4% on employment. The reduction in particulate emissions, precursors of ozone and nitrogen and sulphur oxides, will also have a positive impact on air quality and improve public health, especially in dense urban areas.

The investment associated with decarbonising the economy drives innovation and qualified employment, above all in green sectors. To promote the creation of jobs associated with new investment, it is necessary to prepare employment in sectors that will have to adapt. It is thus fundamental to consider the specificities of the different sectors and prepare specific measures for the most energy-intensive sectors, focusing on supporting the transition, both with regard to reconverting activities as well as with respect to workers, particularly in regions that could be most affected by this transition. It is hence particularly important to create competences aimed at the jobs of the future.

Furthermore, internalising the environmental impact associated with fossil fuels and progressively eliminating tax exemptions on these fuels can have different consequences on society, even though it is a fairer measure. It is thus vitally important for associated tax revenues to be recycled for the benefit of society, supporting decarbonisation projects, reducing the onus on labour and minimising the associated social impact.

This transition must also not accentuate energy poverty. Situations of energy poverty must be identified and obviated by means of measures aimed, above all, at urban rehabilitation, to promote energy efficiency in buildings, especially focusing on insulation and measures to reduce dependence on fossil fuels. In this regard, focusing on the decentralised production of electricity based on renewable energy communities and the improvement of collective systems that attenuate maintenance costs can be solutions, as they make it possible to reduce energy costs and ease the financial burden on families. This path is already being implemented.

As has been recognised internationally, this transition will be financed not just by public funds but also implemented through the private sector and families. Thus, aligning public and private financial flows and tax policy with decarbonisation and energy transition objectives is vital to the success of this transition.

Implementing this transition entails promoting investment in diverse sectors of activity. In this regard, the next Multiannual Financial Framework 2021-2027, which is still being discussed, is particularly relevant as it will provide one of the main sources of funding for decarbonising the economy in coming years. This is because it is expected to contain a commitment (still being negotiated) to allocate 25% of the overall budget to expenditure for climate action. The preparation of the funding plan for the 2021-2027 period will reflect the guidelines set out in this plan, more specifically in relation to the axes of sustainable mobility, decarbonising industry, renewable energies and energy efficiency, smart and sustainable cities, carbon sinks, sustainable agriculture and bioeconomy, among other relevant aspects.

This new energy model for carbon neutrality represents a unique opportunity for Portugal. In relation to the economic recovery which the country has achieved in recent years, the challenge of energy transition is seen as an opportunity which will allow the economy to be leveraged. The aim is to achieve sustainable development based on a democratic and fair model which promotes the advance of civilization and technology, the creation of jobs and prosperity, the creation of wealth and territorial cohesion while also preserving natural resources. The path to the decarbonisation of the economy is also an opportunity for economic growth.

A society tending towards carbon neutrality, based on a circular economy which conserves resources at their highest economic value is also one which creates better qualified employment, more sustained wealth and more shared well-being.

1.1.3. Overview of the plan's main objectives, policies and measures

Portugal has strong arguments for continuing to be at the forefront of energy transition and aims to achieve a carbon neutral economy. This is why both nationally as well as on a European level that Portugal has advocated higher ambitions to reduce GHG, to incorporate sources of renewable energy in various sectors, energy efficiency and interconnections within the 2030 horizon. This is reflected in the following goals:

Table 2- Portuguese targets for the 2030 horizon

EMISSIONS (Without LULUCEF; in relation to 2005)	**ENERGY EFFICIENCY**	**RENEWABLES**	**RENEWABLES IN TRANSPORT**	**ELECTRICITY INTERCONNECTIONS**
-45% to -55%	**35%**	**47%**	**20%**	**15%**

Figure 4 – Evolution in total emissions of CO_2 for the 2030 horizon (Mton CO_2)

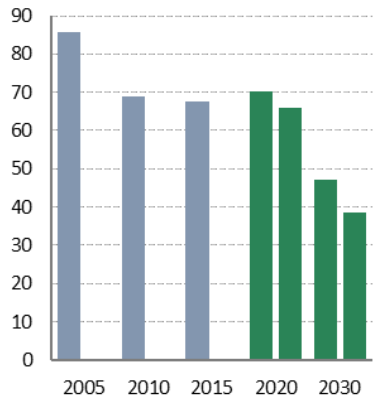


Figure 5 - Estimated evolution in primary energy consumption - EE target (Mtoe)

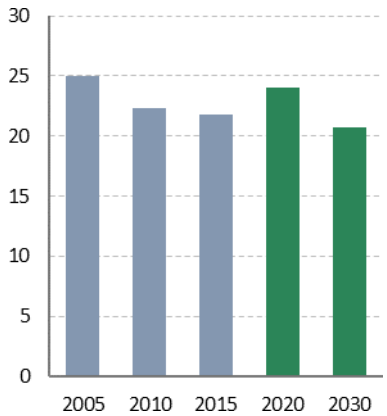


Figure 6 - Evolution in the contribution of renewable energies in final energy consumption

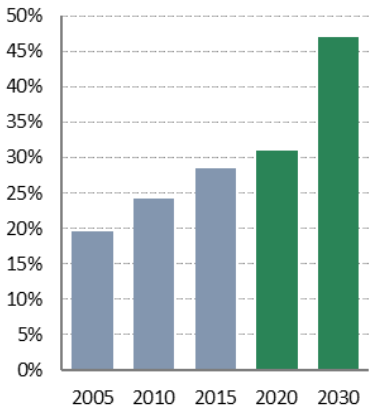


Figure 7 - Evolution in the contribution of Renewable energies in electricity

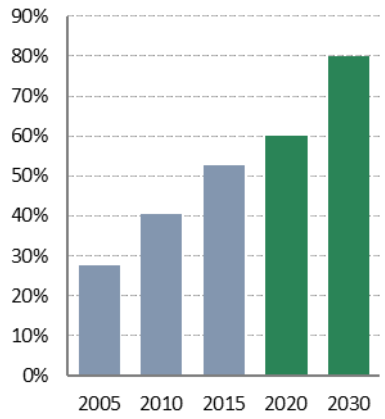


Figure 8 - Evolution in the contribution of Renewable energies in transport

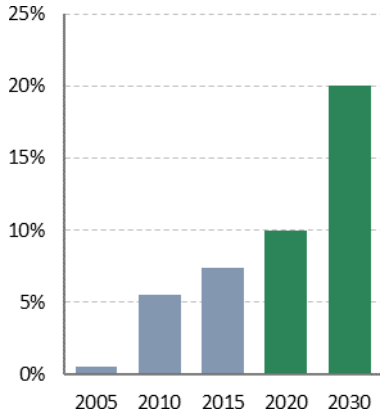
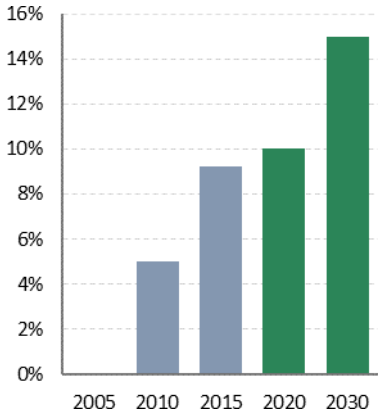


Figure 9 - Evolution of the PT-ES interconnection capacity



This new energy model for carbon neutrality represents a unique opportunity for Portugal. As such, NECP was developed with an emphasis on the participation of society, whose contribution is vital for a strategic vision for the next decade. In relation to the economic recovery which the country has achieved in recent years, the challenge of energy transition is seen as an opportunity which will allow the economy to be leveraged. The aim is to achieve sustainable development based on a just and cohesive transition which promotes the advance of civilization and technology, the creation of jobs and prosperity, while also preserving natural resources. The path to the decarbonisation of the economy is also an opportunity for economic growth and territorial improvement.

In line with the strategic vision defined for the five dimensions of the Energy Union and Climate Action, the following figure shows national targets and contributions defined for the 2030 horizon under NECP.

Table 3- National targets and contribution to Union targets

TARGETS 2030	NATIONAL CONTRIBUTION TO UNION TARGETS
Reduction of CO_{2e} emissions (without LULUCF) (Mt CO_{2e}), with respect to 2005	-17%
Reinforce the weighting of renewable energies	47%
Increasing Energy Efficiency[2]	35%
Electricity interconnections	15%

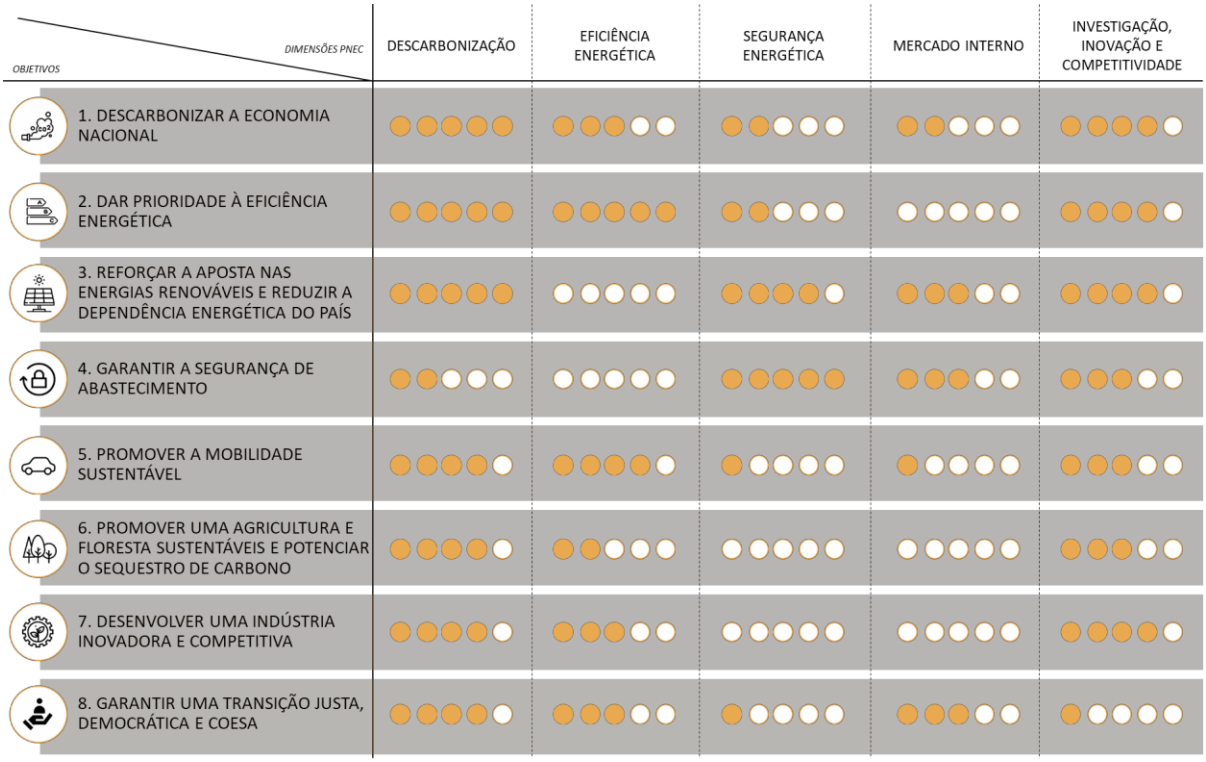
Eight national targets were defined to realise Portugal's strategic vision and ensure compliance with the goals and targets set out for the 2030 horizon, following a logic of integrating energy and climate. Achieving all these targets, all of which are interconnected, will contribute toward making the vision of carbon neutrality a reality.

[2] % reduction in primary energy consumption

Figure 10 - Portuguese targets for the 2030 horizon

These eight national targets set out for the 2030 horizon make a positive contribution toward implementing the five dimensions strategy of NECP, wherein each target can contribute toward more than one dimension, as shown in the following chart.

Figure 11 - Relationship between national objectives and the dimensions of NECP



Key

PT	EN
OBJETIVOS	OBJECTIVES
1. DESCARBONIZAR A ECONOMIA NACIONAL	1. DECARBONISE THE NATIONAL ECONOMY
2. DAR PRIORIDADE À EFICIÊNCIA ENERGÉTICA	2. PRIORITISE ENERGY EFFICIENCY
3. REFORÇAR A APOSTA NAS ENERGIAS RENOVÁVEIS E REDUZIR A DEPENDÊNCIA ENERGÉTICA DO PAÍS	3. REINFORCE THE FOCUS ON RENEWABLE ENERGIES AND REDUCE THE COUNTRY'S ENERGY DEPENDENCY
4. GARANTIR A SEGURANÇA DE ABASTECIMENTO	4. ENSURE SUPPLY SECURITY
5. PROMOVER A MOBILIDADE SUSTENTÁVEL	5. PROMOTE SUSTAINABLE MOBILITY
6. PROMOVER UMA AGRICULTURA E FLORESTA SUSTENTÁVEIS E POTENCIAR O SEQUESTRO DE CARBONO 7. DESENVOLVER UMA INDUSTRIA INOVADORA E COMPETITIVA	6. PROMOTE SUSTAINABLE AGRICULTURE AND FORESTRY AND DRIVE CARBON SEQUESTRATION 7. DEVELOP AN INNOVATIVE AND COMPETITIVE INDUSTRY
8. GARANTIR UMA TRANSIÇÃO JUSTA, DEMOCRÁRICA E COESA	8. ENSURE FAIR, DEMOCRATIC AND COHESIVE TRANSITION
DIMENSÕES PNEC	NECP DIMENSIONS
DESCARBONIZAÇÃO	DECARBONISATION
EFICIÊNCIA ENERGÉTICA	ENERGY EFFICIENCY
SEGURANÇA ENERGÉTICA	ENERGY SECURITY
MERCADO INTERNO	INTERNAL MARKET
INVESTIGAÇÃO, INOVAÇÃO E COMPETITIVIDADE	RESEARCH, INNOVATION AND COMPETITIVENESS

1.2. Overview of the current policy situation

1.2.1. National and EU energy system and the policy context of the national plan

The Paris Agreement (PA) signed in 2015 established long-term objectives to contain the rise in average global temperature to a maximum of 2°C above pre-industrial levels. The international community committed to make every effort to ensure that this rise in temperature does not exceed 1.5°C, which science has defined as the maximum increase for life on the planet to continue without excessive disruption. It also set out objectives to increase the capacity to adapt to the adverse impacts of climate change and to mobilise financial resources in a manner that is consistent with low emission trajectories and resilient development.

This Agreement thus represents a paradigm shift in the implementation of the United Nations Framework Convention on Climate Change, explicitly recognising that the challenge of climate change can only be overcome if everyone contributes to the effort. Its main commitments are to achieve a balance on a global level between human emissions and emissions removal during the second half of the century, to successively prepare and communicate the 'Nationally Determined Contributions' (NDC) for the global effort to reduce emissions, which must be progressively more ambitious and to prepare and communicate 'Long-Term Strategies to reduce emissions'.

The European Commission has introduced a series of strategic packages which seek to address the different aspects of this global challenge. Of note among these packages are the 2030 Climate and Energy Package and Clean Energy for All Europeans, which have the aims of promoting energy transition in the 2021-2030 decade and complying with the Paris Agreement while also safeguarding economic growth and the creation of jobs.

To this end, pursuant to Regulation (EU) 2018/1999 of 11 December 1999 on the Governance of the Energy Union and Climate Action, the European Union approved a set of ambitious goals that aim to achieve by 2030: (i) 32% of energy share from renewable sources in gross final consumption, (ii) 32.5% reduction in energy consumption, (iii) 40% reduction in GHG emissions as compared to 1990 levels, and (iv) 15% of electricity interconnections.

It is also important to use the Agenda 2030 for Sustainable Development – 'Transforming Our World' approved by the United Nations General Assembly on 25 September 2015 as a reference. This document addresses various dimensions of sustainable development (social, economic, environmental) and promotes peace, justice and effective institutions. Agenda 2030 is a universal agenda, based on 17 Sustainable Development Goals (SDG) and 169 targets to be implemented by all countries and compliance presupposes the integration of these goals and targets in policies, processes and actions developed as part of national, regional and global plans.

More recently, after the publication of the IPCC special report on the impact of global warming of 1.5°C above pre-industrial levels, which reinforces the urgency of actions to combat climate change, on 28 November 2018 the European Commission presented a proposal for a long-term strategy for a prosperous, modern, competitive and carbon neutral economy – 'A clean planet for all' - which defines the Commission's vision for a Europe that is carbon neutral and prosperous in relation to the climate by 2050.

According to this strategy, forecasts indicate that the policies and goals that have already been established for the EU as a whole will enable a reduction in GHG emissions of about 45% by 2030 and about 60% by 2050. However, to contribute effectively toward the goals of the Paris Agreement, the EU must be carbon neutral by 2050, which corresponds to reductions of 80%-95% in GHG emissions.

Thus, it is vital to delineate the best path to achieve this goal, aligning actions in key areas, investing in cost-effective and low-carbon technological solutions, promoting the active participation of citizens and ensuring fair transition.

Equally relevant in the context of the current NECP are proposals now underway for the post-2020 period concerning the Common Agricultural Policy (CAP) and the Multiannual Financial Framework (MFF) for 2021-2027. Thus, the CAP Strategic Plan (CAPSP), to be submitted by Member States to the Commission, must be duly aligned with the policy orientations, action lines and action measures set out in the current NECP.

At a national level, in 2016 the Portuguese government committed to achieving carbon neutrality by the end of 2050 and outlined a clear vision for the profound decarbonisation of the national economy, as a contribution toward the Paris Agreement and in keeping with efforts that are underway internationally. The Roadmap for Carbon Neutrality 2050 (RCN 2050) was developed and approved to implement this plan and formed the long-term development strategy for low greenhouse gas emissions submitted to the UNFCCC on 20 September 2019, identifying the main vectors for decarbonisation and action lines to achieve a carbon neutral society by 2050.

To achieve carbon neutrality by 2050, it is necessary to reduce GHG emissions by between 85% to 90% as compared to 2005 and achieve carbon sequestration of between 9 to 13 million tonnes of CO2 by 2050. Achieving carbon neutrality by 2050 requires the total decarbonisation of the electricity generation system and urban mobility, profound changes in the way how we use energy and resources, focusing on circular models, along with promoting carbon sequestration capacities through forests and other land use.

In keeping with the IPCC special report on 1.5° C and the Paris Agreement targets, the most significant reduction in emissions would occur during the 2021-2030 decade.

Pursuant to this framework, by 2030 emissions must be reduced by between 45% and 55% as compared to 2005, which means increasing the established goal (40%) by between 5 and 15 percentage points. In 2040, emissions must be reduced by between -65% to -75% and by -85% to -90% by 2050.

The current National Energy and Climate Plan was developed in cooperation with the tasks of the Roadmap for Carbon Neutrality 2050, using different interactions with society promoted in this context to achieve the pathway and orientation that have been set out for this long-term exercise for the 2030 horizon.

Portugal is a nation that has proved itself in relation to climate policy, having surpassed the targets set out by the Kyoto Protocol and it is on track to comply with the goals established for 2020 to reduce GHG emissions, increase energy efficiency and promote renewable sources of energy.

For the 2030 horizon, the first step toward implementing the national plan of the European Climate and Energy Package for 2030 was taken in 2015 with the approval of the Strategic Framework for Climate Policy (*Quadro Estratégico para a Política Climática* - QEPiC)[3], with a view to decarbonising the economy and ensuring that Portugal had better conditions to overcome the challenges created by the Paris Agreement. QEPiC established an integrated, complementary and coordinated framework of climate policy instruments for the 2020/2030 horizon, coordinated with air policies, having approved the National Programme on Climate Change (*Programa Nacional para as Alterações Climáticas* - PNAC 2020-2030), which identifies guidelines for policies and measures capable of ensuring compliance with the new emission reduction goals for 2020 and 2030, and the National Strategy for Adaptation to Climate Change (*Estratégia Nacional de Adaptação às Alterações Climáticas* - ENAAC 2020). These strategies established that Portugal would reduce its GHG emissions to values of -18 % to -23 % in 2020 and -30 % to -40 % by 2030, as compared to figures for 2005, contingent on the results of European negotiations, and sectorial goals were also set out to reduce GHG emissions.

The establishment of these goals was set out in the previous National Low Carbon Roadmap 2050 *(Roteiro Nacional de Baixo Carbono 2050* - RNBC), which was the first exercise to model national long-term emissions, carried out at a national level. It identified that it was possible to achieve reductions in national emissions of between -50% and -60%, as compared to 1990, which corresponds to a reduction of -60% to -70% in the energy sector as compared to 1990.

It can be seen, however, that the potential for reducing emissions that was modelled at the time has already been exceeded today, essentially as a result of a quicker evolution in technology than had been anticipated. This resulted in a revision of the said goals to be even more ambitious in reducing GHG emissions in the medium and long-term, carried out within the scope of the current RCN 2050.

The Inter-Ministerial Commission for Air, Climate Change and Circular Economy (CA2) was also created in 2015 as was the National System for Policies and Measures (*Sistema Nacional de Políticas e Medidas* - SPeM)[4], which integrates policies and measures with a view to decarbonising the various sectors involved. As a result of efforts under SPeM and under the aegis of the CA2, a set of sectorial measures was identified to decarbonise the economy, which was the starting point for identifying the lines of action and action measures set out in the current plan.

In relation to renewable energy and energy efficiency, with a view to integration, Portugal currently has a National Action Plan for Renewable Energy (*Plano Nacional de Ação para as Energias Renováveis* - PNAER 2020)[5] and a National Action Plan for Energy Efficiency (*Plano Nacional de Ação para a Eficiência Energética* - PNAEE 2020)[6], to promote renewable energy and make energy efficiency a priority for energy policies.

In terms of background, it is important to note that Portugal, in the context of Agenda 2030 for sustainable development, had already defined SDG 13 – Climate Action to be a priority target. The identification of SDG 13 as a priority target is directly related to Portugal's ambitions in terms of complying with SDG 7 – Affordable and Clean Energy for all. In addition to the aforesaid targets, SDG 4 – Quality Education, SDG 5 – Gender Equality, SDG 9 – Industry, Innovation and Infrastructure and SDG 10 – Reduced Inequality were also identified as priorities

[3] Council of Ministers Resolution No 56/2015 of 30 July 2015

[4] Council of Ministers Resolution No 45/2016 of 26 August 2016

[5] Council of Ministers Resolution No 20/2013 of 10 April 2013

[6] Council of Ministers Resolution No 20/2013 of 10 April 2013

The challenge for coming years is to ensure that the national authorities, the private sector and civil society implement the commitments that have been made internationally to reduce GHG emissions, simultaneously raising the percentage of renewables in the energy mix while improving energy efficiency and the capacity for interconnection, as well as gradually increasing the level of ambition in complying with the Paris Agreement.

NECP also contributes toward achieving other sustainable development targets, especially SDG 1 – Eradicating Poverty, SDG 3 – Good Health and Well-being; SDG 4 – Quality Education; SDG 8 – Decent Work and Economic Growth; SDG 9 – Industry, Innovation and Infrastructure; SDG 11 – Sustainable Cities and Communities; SDG 12 – Responsible Consumption and Production and SDG 15 – Protect Life on Land.

The Regulation on the Governance of the Energy Union and Climate Action, approved under the Clean Energy Package for all Europeans, presented by the European Commission in 2016, requires all Member States to prepare and submit an Integrated National Energy and Climate Plan (NECP) to the European Commission for the 2021-2030 horizon. This plan also requires Member States to set out targets, objectives and the respective policies with regard to decarbonisation, GHG emissions, renewable energies, energy efficiency, energy supply security, the internal market and research, innovation and competitiveness, as well as a clear approach as to how to achieve these goals and targets. NECP will be the main instrument for energy and climate policy for 2021-2030.

1.2.2. Current energy and climate policies and measures across the five dimensions of the Energy Union

Portugal already has a vast set of sector instruments in the area of climate action and energy, which has allowed the country to efficiently implement commitments made at a Community and international level.

In this regard, the National Programme on Climate Change (PNAC 2020/2030), approved in 2015 by Council of Ministers Resolution No 56/2015 of 30 July 2015, the National Action Plan for Renewable Energy 2013-2020 (PNAER) and the National Action Plan for Energy Efficiency 2013 - 2016 (PNAEE), approved in 2013 by Council of Ministers Resolution No 20/2013 of 10 April 2013, are especially worthy of note. They have now been substituted by the current National Energy and Climate Plan.

Moreover, the following list identifies the main sector policy instruments at a national level that are currently in force or at a final phase of implementation, which contribute toward compliance with the goals and targets concerning energy and climate as set out in the current NECP. They also contribute toward aspects of the Energy Union – decarbonisation, energy efficiency, energy security, internal energy market and research, innovation and competitiveness.

These instruments are worthy of note owing to their transversal nature, especially the National Programme for Spatial Planning Policy (*Programa Nacional da Política de Ordenamento do Território* - PNPOT), Circular Economy Action Plan (PAEC) and the Roadmap for Carbon Neutrality (RCN 2050), which comprise the three main axes of the Environment and Climate Action policy. They respectively represent policies for improving the territory, a circular economy and decarbonising society. The coordination and interconnection of these three axes, as well as energy transition, are essential aspects to consider in the context of preparing the current NECP.

Current TRANSVERSAL policies and measures:

- Roadmap for Carbon Neutrality (RCN 2050), approved by Council of Ministers Resolution No 107/2019 of 1 July 2019.
- National Strategy for Adaptation to Climate Change (ENAAC 2020, approved by Council of Ministers Resolution No 56/2015 of 30 July 2015 which also created the National Policies and Measures System later governed by Council of Ministers Resolution No 45/2016 of 26 August 2016;

- Action Programme for Climate Change Adaptation (P-3AC), approved by Council of Ministers Resolution No 130/2019 of 2 August 2019.
- National Strategy for the Air (ENAR 2020), approved by Council of Ministers Resolution No 46/2016 on 26 August 2016.
- Circular Economy Action Plan (PAEC), approved by Council of Ministers Resolution No 190-A/2017;
- National Programme for Spatial Planning Policy (PNPOT), approved by Law No 99/2019 of 5 September 2109;
- National Plan for Territorial Cohesion, approved by Council of Ministers Resolution No 72/2016 of 24 November 2016.
- National Action Programme to Combat Desertification (PANCD), approved by Council of Ministers Resolution No 78/2014 of 24 December 2014.
- National Strategy for Sustainable Cities 2020, approved by Council of Ministers Resolution No 61/2015 on 11 August 2015.
- National Strategy for Ecological Public Procurement (ENCPE 2020), approved by Council of Ministers Resolution No 38/2016 of 29 July 2016.
- National Strategy for the Preservation of Nature and Biodiversity 2030 (ENCNB 2030), approved by Council of Ministers Resolution No 55/2018 of 7 May 208;
- National Strategy for Environmental Education (ENEA 2020), for 2017-2020, approved by Council of Ministers Resolution No 100/2017 of 11 July 2017.
- European Emissions Trading Scheme (EU ETS), Decree-Law No 38/2013 of 15 March 2013 and Decree-Law No 93/2010 of 27 July 2010.
- National Strategy for a Sustainable Bioeconomy 2030, under development.

Current policies and measures in the ENERGY sector:

- National Action Plan for Renewable Energy 2013-2020 (PNAER) and the National Action Plan for Energy Efficiency 2013-2016 (PNAEE), approved by Council of Ministers Resolution No 20/2013 of 10 April 2013.
- National Programme for High Hydroelectric Potential Dams (PNBEPH);
- National Plan for the Promotion of Bio-refineries, approved by Council of Ministers Resolution No 163/2017 of 31 October 2017.
- Industrial Strategy and Action Plan for Renewable Ocean Energy, approved by Council of Ministers Resolution No 174/2017 of 24 November 2017.
- Energy Efficiency Programme for Public Administration - ECO.AP, created through Council of Ministers Resolution No 2/2011 of 12 January 2011.
- Monitoring Report on the Supply Security of the National Electricity Production System for 2018 and 2019 and Monitoring Report on the Supply Security of the Natural Gas System 2018 and 2019;
- National Electricity Transmission Network Development and Investment Plan for the period 2018-2027, being assessed;
- Liquefied Natural Gas National Transmission System, Infrastructure, Storage and Terminal Development and Investment Plan for the period 2018-2027;
- National Electricity Transmission Network Development and Investment Plan for the period 2019-2023, being assessed;
- National Natural Gas Distribution System Development and Investment Plan for the period 2019-2023 being assessed;

Current policies and measures in the WASTE AND WASTEWATER sector:

- Urban Waste Strategic Plan (PERSU 2020+), approved by Ministerial Implementing Order No 241-B/2019 of 31 July 2019;
- Legal regime for the production and use of water for re-use, obtained from the treatment of wastewater, approved by Decree-Law 119/2019 of 21 August 2019;
- National Strategy for Fighting Food Waste (ENCDA), approved by Council of Ministers Resolution No 46/2018 of 27 April 2018.
- National Waste Management Plan 2014-2020 (PNGR), approved by Council of Ministers Resolution No 11-C/2015 of 16 March 2015.
- Strategic Plan for Water Supply and Waste Water Sanitation (PENSAAR 2020), approved by Official Order No 4385/2015 of 30 April 2015;

Current policies and measures in the AGRICULTURE AND FORESTRY sector:

- Rural Development Programme for 2014-2020 (RDP 2020), approved by Commission Implementing Decision C(2014) 9896 of 12 December 2014;
- National Strategy for Agricultural and Agro-Industrial Effluents (ENEAPAI) 2018-2025, being revised;
- National Strategy for the Reuse of Wastewater and Action Plans for the 50 largest urban WWTP in the country by 2020[7], under development;
- National Strategic Plan for Water Supply Services and Wastewater Sanitation 2020-2030, under development;
- National strategy for the management of sludge, currently being finalised;
- Good Agricultural Practices Code (CBPA), approved by Official Order No 1230/2018 of 5 February 2018;
- National Forestry Strategy (ENF), review approved by Council of Ministers Resolution No 6-B/2015 of 4 February 2015;
- National Strategy for the Promotion and Production of Cereals, approved by Council of Ministers Resolution No 101/2018 of 26 July 2018.
- National Strategy for Biological Agriculture (ENAB), approved by Council of Ministers Resolution No 110/2017 of 11 July 2017.
- National Irrigation Plan, approved through Council of Ministers Resolution No 133/2018 of 12 October 2018.
- Common Agricultural Policy Strategic Plan (PEPAC 2021-2027), under development;

Current policies and measures in the MOBILITY AND TRANSPORT sector:

- Transport and Infrastructure Strategic Plan (PETi3+) for 2014-2020, approved by Council of Ministers Resolution No 61-A/2015 of 20 August 2015
- Sustainable Mobility Programme for Public Administration - ECO.mob 2015-2020, approved by Council of Ministers Resolution No 54/2015 of 28 July 2015.
- National Strategy for Cycle Mobility (EMNAC) 2020-2030, approved by Council of Ministers Resolution No 131/2019 of 2 August 2019.

Current policies and measures in the RESEARCH AND INNOVATION sector:

- Strategy for Research and Innovation for a Smart Specialisation EI&I, 2014-2020, approved on 23 December 2014;
- Research and Innovation Themed Agendas 2030, under development by FCT further to Council of Ministers Resolution No 32/2016 of 3 June 2016.

[7] To enable wastewater so treated to be used for other purposes (e.g. irrigation, supplying fire fighting corporations, washing public roads or cleaning cars)

Current FINANCIAL policies and measures:

- National Investment Programme (NIP 2030), approved by Portuguese National Parliament Resolution No 154/2019 of 23 August 2019;
- Carbon tax, Law No 82-D/2014 of 31 December 2014, which approved the Green Taxation Reform;
- Financial support for electric mobility and the acquisition of vehicles producing less emissions in public transport fleets;
- Tariff Reduction Support Programme (PART), approved by Official Order No 1234-A/2019 of 4 February 2019;
- Remuneration Programme for Rural Space Ecosystems Services (2019-2038), approved by Council of Ministers Resolution No 121/2019 of 30 July 2019.
- Removal of tax exemptions on coal by 2030, State Budget Law 2018.

Regional context

The Autonomous Region of the Azores (ARA) and the Autonomous Region of Madeira (ARM) are two archipelagos located in the Atlantic Ocean and they are two outermost regions of Portugal. They enjoy administrative and political autonomy, having been granted political, legislative and administrative powers. In matters such as energy, the climate or mobility, the autonomous regions develop their own strategies and plans, considering the reality of each region, albeit aligned with the goals and main targets set out at a national level, as is the case of the national goal for renewable energy and the target to reduce emissions.

The main sector policy instruments at a regional level that are currently in force or in a final phase of implementation, which contribute toward compliance with the goals and targets concerning energy and climate and simultaneously contribute toward aspects of the Energy Union – decarbonisation, energy efficiency, energy security, internal energy market and research, innovation and competitiveness – are identified below:

AUTONOMOUS REGION OF THE AZORES

Current TRANSVERSAL policies and measures:

- Regional Climate Change Programme (PRAC), approved by Regional Legislative Decree No 30/2019/A of 28 November 2019;
- Regional Climate Change Strategy (PRAC);
- Territorial Management Instruments.

Current policies and measures in the ENERGY sector:

- Azores Energy Strategy 2030 (EAE 2030), currently being developed;
- Regional Action Plan for Energy Efficiency (PRAEE), currently being developed;
- Programme for Energy Efficiency in the Public Administration (ECO.AP Azores), approved by Regional Legislative Decree No 19/2019/A of 6 August 2019;
- ProEnergia Programme (system of incentives for producing and storing energy from renewable sources), Regional Legislative Decree No 14/2019/A of 12 June 2019, which implemented the second amendment to Regional Legislative Decree No 5/2010/A of 23 February 2010;
- Multiannual Strategic Plan and Budget 2019 of EDA (PEPO 2019);
- Strategy to incorporate renewable technologies to produce energy for the fisheries sector.

Current policies and measures in the MOBILITY AND TRANSPORT sector:

- Strategy to Implement Electric Mobility in the Azores (EMEA), Regional Legislative Decree No 21/2019/A of 8 August 2019;

- Plan for Electric Mobility in the Azores (PMEA) 2018-2024, approved by Government Council Resolution No 106/2019 of 4 October 2019;
- Plan for Sustainable Urban Mobility in the Azores (PUMS).

Current policies and measures in the WASTE sector:

- Azores Strategic Waste Management and Prevention Plan (PEPGRA), approved by Regional Legislative Decree No 6/2016/A of 29 March 2016 ERSE instruction No 6/2016 of 29 December 2016.

Current policies and measures in the AGRICULTURE sector:

- Strategy to Develop Organic Agriculture and Action Plan to Promote Organic Products for the Autonomous Region of the Azores, approved by Government Council Resolution No 57/2019 of 24 April 2019.

AUTONOMOUS REGION OF MADEIRA

Current TRANSVERSAL policies and measures:

- Strategy to Adapt to Climate Change, approved by Government Council Resolution No 1062/2015 of 26 November 2015 (to be updated shortly);
- Regional Circular Economy Agenda;
- Regional Energy and Climate Plan for the Autonomous Region of Madeira (under preparation).

Current policies and measures in the ENERGY sector:

- Sustainable Energy Action Plan for the Island of Madeira, currently being reformulated/updated;
- Sustainable Energy Action Plan for the Island of Porto Santo, currently being reformulated/updated.

Current policies and measures in the MOBILITY AND TRANSPORT sector:

- Action Plan for Sustainable Urban Mobility in the Autonomous Region of Madeira (PAMUS-RAM), Approved by Council of Ministers Resolution No 378/2019 of 21 June 2019;
- Integrated Strategic Plan for Transport of the Autonomous Region of Madeira (PIETRAM) 2014-2020.

Current policies and measures in the WASTE sector:

- Strategic Waste Document 2020-2030.

1.2.3. Key issues of cross-border relevance

Of note is the agreement in 2006 between Portugal and Spain to create the Iberian Electricity Market (MIBEL) with the aim of establishing interconnections with commercial capacity of 3 000 MW so as to promote and reinforce price convergence between both markets, as well as strengthen supply security.

With regard to regional cooperation in relation to trans-border interconnections, the signing of the Madrid Declaration in 2015 and more recently the signing of the Lisbon Declaration in July 2018 (at the Energy Interconnection Summit) led to a commitment by Portugal, Spain, France and the European Commission to build the necessary infrastructures for implementing an efficient and decarbonised internal energy market. This is particularly important with respect to the trans-border interconnections for gas and electricity networks in Member States which have not yet reached a minimum level of integration into the internal energy market, as is the case with Spain and Portugal.

More recently, the Valladolid Declaration was signed in November 2018 between Portugal and Spain in which both Governments emphasised the importance of energy supply security at a European level and the need to

foment trans-border and inter-regional interconnections to achieve greater integration of the Iberian market/Iberian Peninsula with the rest of Europe, thus promoting the Energy Union and maximising existing European funding mechanisms. With the aim of meeting the challenge to incorporate renewable energies and the development of MIBEL, both governments reaffirmed the importance of the internal and external MIBEL interconnection.

1.2.4. Administrative structure for implementing national energy and climate policies

Monitoring the implementation of Portugal's policies, measures and actions is vital in managing national climate and energy policies, insofar as it allows not only the progress being achieved to be assessed but also ensures compliance with the commitments made at a Community level pursuant to the Regulation on the Governance of the Energy Union and Climate Action and the Effort Sharing Regulation. On an international level, it ensures compliance with the United Nations Framework Convention on Climate Change (UNFCCC).

It is thus important to maximise already existing national monitoring structures, adapting them to this new and more integrated reality of energy and climate policies.

The National System for Policies and Measures (SpeM) will be used to this end, which was created by Council of Ministers Resolution No 56/2015 of 30 July 2015 and subsequently governed by Council of Ministers Resolution No 45/2016 of 26 August 2016, adapting it to include the monitoring of the policies, measures and forecasts that impact on energy transition.

This system therefore promotes the debate, design and assessment of progress being made to implement the policies and measures that help reduce GHG emissions and assist in energy transition. This is in line with the targets set out at a national level in this integrated Plan, reinforcing the responsibility of the sectors to incorporate these dimensions into their sectorial policies.

It also aims to help meet the monitoring, reporting and forecasting requirements set out in the Governance Regulation, which are largely derived from the requirements previously set out in Regulation (EU) 525/2013 of the European Parliament and of the Council of 21 May 2013 (MMR).

Moreover, considering the existing synergies between climate and energy policies and policies and measures for Air, SPeM will continue to support monitoring as well as forecasts in this context. It will also ensure suitable coordination with the National Emissions Inventory System by Sources and Removal of Air Pollutants by Sinks (*Sistema Nacional de Inventário de Emissões por Fontes e Remoção por Sumidouros de Poluentes Atmosférico* - SNIERPA) and the monitoring and reporting system set out in the National Strategy for Adaptation to Climate Change (ENAAC 2020).

A platform to monitor and report on the impact of the transversal and sectorial policies and measures concerning climate change and energy transition will also be developed, in conjunction with the sectors, by defining indicators and identifying the respective regulatory, financial and taxation instruments.

Governance Model

Considering the strategic and transversal nature of energy transition, which has an impact on diverse levels of the economy and society, it is essential for the governance model to reflect the political commitment to this theme and to be implemented by means of effective action and support for progress in the transition. Thus, coherent coordination of the different components set out in this plan entails defining a system of governance, with suitable instruments, without prejudice to the specific competences assigned to the different sectors.

The political effort invested in the transition to a competitive, resilient, low-carbon and circular economy which is fully integrated with the targets for economic growth resulted in the creation of the CA2 in 2015 of the

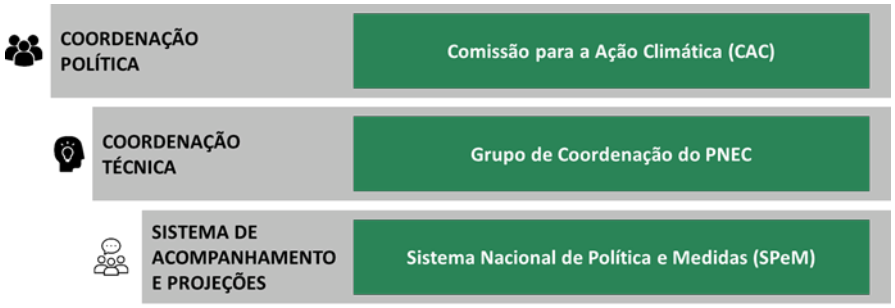
Inter-ministerial Commission for Air, Climate Change and the Circular Economy (CA2). This commission is presided over by the member of the government responsible for the environment, climate action and energy transition and includes representation by government departments in the sectors of energy, spatial planning, treasury, agriculture, the sea, the economy and innovation, transport, health, tourism, civil protection, regional development, local government, foreign affairs and cooperation, education and science and by representatives of the regional governments of the Azores and Madeira.

This Commission provides policy guidelines with regard to climate change and air and also coordinates and integrates climate change policies in sector policies, while monitoring the implementation of the relevant sector measures, programmes and actions that are implemented. The specific competences of CA2 are set out in Official Order No 2873/2017 of 6 April 2017. These competences include the monitoring of compliance with commitments assumed by Portugal on a national and Community level and with regard to the United Nations, the promoting and monitoring of relevant national plans on climate change and circular economy, the validation of proposed policy options and measures with respect to mitigation, monitoring and support for establishing national positioning in international negotiations.

Thus, once again using governing structures that already exist at a national level, this Commission will also monitor energy policy and sector policies impacting on national targets concerning air, climate change, circular economy and energy, considering the synergies between these themes. It will also promote, supervise and monitor NECP.

To this end, the proposed model aims, firstly, to ensure a long-term political commitment, since the transition to a carbon neutral society is extremely relevant nationally and internationally and impacts on the economy and society, while also presenting an opportunity for Portugal. The governance model covers the following levels:

Figure 12 - Overview of the governance structure



Key

PT	EN
COORDENAÇÃO POLÍTICA	**POLICY COORDINATION**
COORDENAÇÃO TÉCNICA **SISTEMA DE ACOMPANHAMENTO E PROJEÇÕES**	**TECHNICAL COORDINATION** **MONITORING AND PROJECTION SYSTEM**
Comissão para a Ação Climática (CAC)	**Commission for Climate Change (CAC)**
Grupo de Coordenação do PNEC	**PNEC Coordination Group**
Sistema Nacional de Política e Medidas (SPeM)	**The National System for Policies and Measures (SPeM)**

The Commission for Climate Action is responsible for NECP **policy coordination** and will act as a structure to promote decision making on a politcy level. To this end it will be necessary to: (i) rename the CA2[8]; (ii) determine that this Commission is responsible for promoting, supervising and monitoring NECP;
(iii) update Official Order No 2873/2017 accordingly. Close coordination with other inter-ministerial commissions must be ensured, considering the importance of this theme for European development and funding policies, as well as to comply with national commitments for SDGs. This will thus ensure policy monitoring, while simultaneously defining priorities, validating responsibilities and setting implementation deadlines.

[8] Created by Council of Ministers Resolution No 56/2015 of 30 July 2015 (QEPiC) and amended by Council of Ministers Resolution No 190-A/2017 of 11 December 2017 (PAEC). Operational regulations approved by Official Order No 2873/2017 of 6 April 2017 by the Minister for the Environment.

The Coordination Group will be responsible for the **technical coordination** of NECP and will coordinate and promote the preparation and revision of NECP and guarantee its coordination with Portugal's contribution for complying with commitments made pursuant to the Regulation on the Governance of the Energy Union and Climate Action and will facilitate the implementation of the policy guidelines set out in NECP. This group to coordinate NECP will be managed by the Portuguese Environmental Agency (*Agência Portuguesa do Ambiente, I.P.* - APA) and by the Directorate-General for Energy and Geology (DGEG). To this end, it will be necessary to: (i) determine its formal creation and (ii) define its composition and competences.

The **system to monitor and prepare forecasts** for NECP will be based on the current system (SPeM) created by Council of Ministers Resolution No 45/2016 of 26 August 2016 and aims: to involve and reinforce the responsibility of sectors to integrate climate aspects into sector policies; ensure accompaniment, monitoring and reporting on the implementation of policies and measures and their effects, and reporting for forecasts of GHG emissions and other air pollutants; assess compliance with Portugal's obligations, including sector goals, under the EU's climate and energy package and air policies for the 2020, 2025 and 2030 horizons, as set out in NECP and ENAR. For this purpose, the following will be necessary: (i) ensure greater dynamism among sectors, creating thematic groups that can meet autonomously, maintaining close coordination with Air Policies by providing greater autonomy; (ii) the coordination of each of the thematic groups will be shared between the NECP Coordination Group and the entity/entities with specific competences in the respective sector (coordinator of the thematic group – current SpeM focal point, other elements – the current SPeM involved entities); (iii) determine that SPeM is the system to monitor NECP policies, measures and forecasts; (iv) suitably adapt Council of Ministers Resolution No 45/2016 of 26 August 2016; (v) develop a reporting platform for transversal and sector policies and measures in conjunction with the sectors, identify the respective funding, regulatory, taxation and other instruments and build indicators and goals.

1.3. Consultations and involvement of national and EU entities and their outcome

1.3.1. Involvement of the national Parliament

Pursuant to the Constitution of the Republic of Portugal, the government is responsible, by means of its administrative competences, for carrying out all acts and implementing all measures necessary to promote socio-economic development and satisfy collective needs, which includes approving the National Energy and Climate Plan 2030.

The National Energy and Climate Plan 2030 (NECP 2030) was approved by a majority in the Council of Ministers on 19 December 2019, by means of a Council of Ministers Resolution, which is awaiting publication.

The national Parliament was involved with respect to the public consultation procedures that were held.

1.3.2. Involvement of local and regional powers

During the course of preparing NECP, meetings and consultations were held with delegations of entities from the Autonomous Regions of Madeira and the Azores pursuant to their autonomy and specific competences. At a local level, the respective entities participated in consultation processes associated with drafting the Plan.

1.3.3. Consultations with stakeholders, including social partners, and engagement of civil society

Institutional and civic participation was encouraged during the technical tasks of the process of preparing NECP and entities representing different sector interests actively cooperated in proceedings through diverse discussions of NECP in various locations around Portugal. This exercise benefited from the process of preparing the Roadmap for Carbon Neutrality 2050, which involved participatory dialogue with society. Various technical sessions were held with agents from the sector and a cycle of thematic sessions was organised in various locations around the country, focusing on transport (Porto), forestry (Pombal) energy (Lisbon) and fair transition (Lisbon).

The entire process of preparing NECP – documents, images and videos of the various sessions – can be consulted on the website www.portugalenergia.pt, which will be constantly updated over the course of this process.

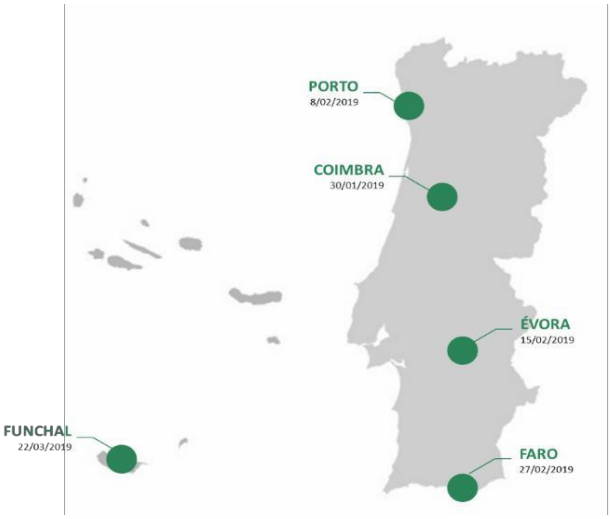
Public presentation of NECP

The process of broad participation while preparing NECP began with a public presentation of the main lines of action for the 2021-2030 period, which took place during a public session held on 28 January in Lisbon. This session was attended by a wide cross-section of stakeholders in this sector, higher education institutions and citizens. Its main purpose was to inform the public with regard to NECP, including Portugal's energy and climate goals and targets for 2030, its vision for this time frame, strategic objectives and the main lines of action.

Decentralised presentation sessions

These sessions sought to disseminate the proposals set out in RCN and NECP and to foment debate around the challenges and opportunities they pose for society. Presentations were given in different parts of the country attended by members of the government, with emphasis on holding various sessions in higher education institutions. A total of five presentations were held between January and March 2018 (Coimbra, Porto, Évora, Faro and Funchal), which included a debate with the participation of diverse specialists from varied areas of energy and climate.

Figure 13 - Decentralised presentation sessions



Themed workshops

Thematic workshops were held with a view to discussing in further detail specific themes relevant to achieving the NECP targets, with the presence of specialists drawn from diverse areas, to find solutions to meet Portugal's goals and targets. The results obtained during these sessions were considered while preparing the current NECP proposal.

- **Thematic workshop on Energy efficiency and Energy Poverty** (Lisbon, 18 March)
  This workshop was organised by the Energy Agency (*Agência para a Energia* – ADENE) and involved specialists from the energy and climate sectors as well as other specialists and representatives of stakeholders in sectors associated with the respective themes. Its main objective was to promote an in-depth discussion on the themes of energy efficiency for buildings and energy poverty, themes that are crucially important to ensure a fair, democratic and cohesive energy transition, creating conditions to achieve the targets set out for 2030 and ensuring carbon neutrality by 2050.
- **Thematic workshop on Research, Development and Innovation** (Lisbon, 3 April)
  This workshop was organised in partnership with the National Laboratory for Energy and Geology, (*Laboratório Nacional de Energia e Geologia* - LNEG) and the Directorate-General for Energy and Geology (DGEG). It involved specialists from the energy and climate sectors as well as other specialists and representatives of stakeholders in sectors associated with the respective themes. Its main objective was to promote an in-depth discussion on the themes of Research, Innovation and Competitiveness, a vitally important theme to create the conditions to achieve the targets set out for 2030 and ensure carbon neutrality by 2050.
- **Thematic workshop on industry** (Aveiro, 17 April)
  This workshop was organised in partnership with the Directorate-General for Energy and Geology (*Direção Geral de Energia e Geologia* - DGEG), the Portuguese Environmental Agency (*Agência Portuguesa do Ambiente* - APA) and the Energy Agency (*Agência para Energia* - ADENE) and involved specialists from the energy and climate sectors, representatives of technological centres and associations connected with the field. Its main objective was to promote discussion on the theme of Industry, crucially important to create the conditions to achieve the targets set out for 2030 and to ensure carbon neutrality by 2050.

Public consultation

After the round of presentations and thematic workshops was concluded, the results of which were incorporated into the current version of the document, a public consultation process was held between 7 May and 5 June 2019. After this process, 59 contributions were received from diverse sectors of the economy and society. These contributions were analysed and incorporated into the version of NECP presented herein.

Strategic environmental assessment

To comply with Decree-Law No 232/2007 of 15 June 2007, which sets out the system to assess the effects of given plans and programmes on the environment, transposing Directive No 2001/42/EC of 27 June 2001 and Directive No 2003/35/EC of 26 May 2003 to national legislation, a Strategic Environmental Assessment (SEA) was carried out for NECP 2030.

The purpose of SEA is to support the decisions made with regard to the plan, by identifying, describing and assessing its strategic environmental effects, so as to determine opportunities and risks for sustainable development. SEA is based on identifying factors that are critical for making decisions, by which the aspects that are most important and relevant to national territory are analysed and assessed in terms of the environment and sustainability, encompassing the sectors included in NECP.

This process began by preparing the Scope Definition Report (SDR) and the respective procedures for consulting with the Entities with Specific Environmental Responsibilities (ESER), pursuant to Decree-Law No 232/2007. Sixteen entities were consulted during this process between 9 July and 9 August 2019 and inputs were obtained

from 9 entities[9]: APA, DGT, ANMP, CCDR Centro, CCDR LVT, GPP, IAPMEI, ICNF and IMT.

An Environmental Report (ER) and the respective non-technical summary were prepared based on these inputs and these documents were similarly submitted to the aforesaid 16 ESER and were made available for public consultation between 7 October and 28 October 2019.

Seven replies were submitted in relation to ESER contributions to the consultations, namely, from APA, IMT, GPP, DG Território, CCDR Algarve, CCDR Alentejo and DGAE. Five entities participated in the public consultation process.

1.3.4. Consultations with other Member States

Consultations with other Member States were conducted through the regional cooperation mechanisms set out in Chapter 1.4 of this plan.

It should also be noted that some of the topics with greater trans-border relevance covered by this plan have been discussed with more relevant Member States, particularly Spain and France, in forums such as the High-Level Group (HLG) in relation to interconnections in Southwest Europe. The Luso-Spanish Summit in Valladolid was also important for strategic commitments in matters which are relevant to NECP, more specifically with respect to interconnections, MIBEL and strategies to comply with the Paris Agreement. The Lisbon Summit, held in July 2018 (2nd Interconnection Summit) between Portugal, Spain, France and the European Commission, is equally of note in this regard.

Consultation is currently underway with Spain in relation to the current version of NECP. A request has already been made to provide the final version of the Spanish NECP for consultation purposes.

1.3.5. Iterative process with the European Commission

Since 2015, Portugal has actively participated in the European Commission Technical Working Group on Integrated National Energy-Climate Plans (TWG NECP), maintaining open communication with the European Commission and other Member States. Through the status updates at the meetings of this Working Group and the quarterly questionnaires, Portugal kept the European Commission regularly informed of work underway to develop the National Plan. Of note with regard to this working group more recently was the holding last September of the bilateral meetings on energy efficiency and renewable energies.

Portugal has also participated on a technical level in the Special Groups, JRC-IDEES (Joint Research Centre Integrated Database on the European Energy System) and POTEnCIA model (Policy-Oriented Tool for Energy and Climate Change Impact Assessment), thus contributing to the ongoing improvement of the database and to the improvement of assumptions and fine tuning of the projection models developed by these groups.

As part of the initiative of the European Semester promoted by the COM, a COM delegation was received in November 2019 to discuss a number of topics associated with preparing NECP. Another COM delegation was also received in the same month and two meetings were held with this delegation, one with the DGEG team and the other with the Portuguese Environment Agency (APA) team, to discuss topics concerning the preparation and contents of the final version of NECP.

[9] Portuguese Environmental Agency (APA); Directorate-General for Territorial Planning (DGT); Foundation for Science and Technology; Entity for Public Administration Shared Services (eSPap); Department of Planning, Policies and General Administration (GPP); Agency for Competitiveness and Innovation (IAPMEI); Institute for the Conservation of Nature and Forests (ICNF); Institute for Habitation and Urban Rehabilitation (IHRU); Institute for Mobility and Transport (IMT); Directorate-General for Economic Activities (DGAE); Commission for Regional Coordination and Development for Northern Portugal (CCDR Norte); Commission for Regional Coordination and Development for Central Portugal (CCDR Centro); Commission for Regional Coordination and Development for Lisbon and the Tagus Valley (CCDR LVT); Commission for Regional Coordination and Development for the Alentejo Region (CCDR Alentejo); Commission for Regional Coordination and Development for the Algarve Region; (CCDR Algarve); and the National Association of Portuguese Municipalities (ANMP)

1.4. Regional cooperation in preparing the plan

1.4.1. Aspects subject to joint planning or coordination with other States

Pursuant to Article 12 of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, Portugal participated in two initiatives aimed at promoting regional cooperation.

The first initiative was promoted by the French Government, in which Portugal participated along with other nations, including Switzerland, in a session to present the French NECP. It also provided an opportunity to discuss themes associated with defining the plans, based on the NECP that was presented.

The second initiative was promoted by the Spanish Government, in which both Portugal and France participated in a meeting where the parties presented their NECPs and the discussions centred on the internal energy market and energy security, especially in relation to energy interconnections.

1.4.2. Explanation of how regional cooperation is considered in the plan

In addition to that mentioned in point 1.4.1, it is important to note that Portugal, as part of foreign policy has promoted numerous interactions with neighbouring Member States, particularly with Spain, at this initial stage of the NECP development process so as to ensure a suitable level of involvement and agreement in areas of cooperation.

Therefore, some of the topics with greater trans-border relevance covered by this plan have been discussed with more relevant Member States, particularly Spain and France, in forums such as the High-Level Group (HLG) in relation to interconnections in Southwest Europe.

The Luso-Spanish Summit in Valladolid was also important for strategic commitments in matters which are relevant to NECP, more specifically with respect to interconnections, MIBEL and strategies to comply with the Paris Agreement. At this summit, and with particular relevance for regional cooperation, the importance of the Iberian Working Group on Renewable Energies was reiterated, as a contribution to promoting joint work by both countries in relation to energy transition. Also, of note in this regard was the 2nd Interconnections Summit, which resulted in the signing of the Lisbon Declaration by Portugal, France, Spain and the European Commission, with a view to reinforcing regional cooperation for the Energy Union and better integrating the Iberian Peninsula into the internal energy market. At this summit, the three countries agreed on a series of common guidelines with respect to energy and climate policy.

2. NATIONAL OBJECTIVES AND TARGETS

2.1. Dimension Decarbonisation

2.1.1. Objectives relating to GHG emissions and removals

i. The Member State's binding national target for GHG emissions and binding national annual limits under Regulation (EU) No 2018/842

Pursuant to Regulation (EU) No 2018/842 of the European Parliament and of the Council of 30 May 2018 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 (known as the Effort Sharing Regulation), a goal was set for the Union stipulating a 30% reduction in its GHG emissions by 2030, as compared to 2005 levels, in the sectors that are not covered by the European Union Emissions Trading Scheme (non-ETS).

National contributions were also established to achieve the Union's aforesaid goal. By 2030, Portugal will limit its GHG emissions by at least 17% as compared to its GHG emissions in 2005 and has committed to this goal at a Community level in non-ETS sectors.

Table 4- Target for the reduction of CO2eq emissions in the non-EU ETS sector (without LULUCF) with respect to 2005

	2020	**2030**
National contribution to Union targets (non-ETS sectors)	+1%	-17%

Thus, for the period between 2021 and 2030, despite the flexibility envisaged in the Effort Sharing Regulation, Portugal must ensure that its GHG emissions in each year do not exceed the limit defined for the linear trajectory set out in the following table.

Table 5- Emissions limit in non-ETS sectors (Mt) [10]

	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Emissions limit in non-ETS sectors	41.01	41.01	41.01	41.01	41.01	41.01	41.00	41.00	41.00	41.00	41.00

ii. The Member State's commitments under Regulation (EU) No 2018/841

Regulation (EU) No 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework (known as the LULUCF Regulation) set out commitments for Member States for the land use sector, land use change and forestry (LULUCF) that also contribute toward achieving the objectives of the AP and the Union goal of reducing GHG emissions for the 2021-2030 period.

[10] The indicative trajectory of emissions is estimated pursuant to Article 4(2) of the Effort Sharing Regulation, using the following values for the indicated years: (i) 2005: total emissions of 85.82 Mt (emissions inventory submitted to the UNFCCC in May 2019); (ii) 2005: emissions from non-ETS sectors of 49.39 Mt (considering the value of verified ETS emissions of 2005 of 36.43 Mt); (iii) 2016: emissions from non-ETS sectors of 41.57 Mt (pursuant to compliance with the Effort Sharing Decision); (iv) 2017: emissions from non-ETS sectors of 40.19 Mt (pursuant to the estimate for compliance with the Effort Sharing Decision); (v) 2018: total emissions of 67.54 Mt (proxy of the emissions inventory submitted to the European Commission in July 2019); (vi) 2018: emissions from non-ETS sectors of 41.28 Mt (considering the value of verified ETS emissions in 2018 of 26.25 Mt).

Thus, for the period between 2021 and 2030, despite the flexibility allowed by the LULUCF Regulation, Member States are required to ensure that emissions from the LULUCF sector do not surpass the removals of the respective sector (known as the 'no debit rule'). This target includes the sum of:

a) forest area sinks planted in the last 20 years;
b) emissions of areas that have been deforested in the last 20 years;
c) sinks or emissions from managed forests, accounted for according to the forest reference level;
d) sinks or emissions of the areas under agriculture and pasture, accounted for according to their levels in 2005-2007;
e) sinks or emissions of the areas under humid zones and water bodies (from 2026 onward), accounted for according to their levels in 2005-2007.

Similarly, pursuant to the approved system, the LULUCF and non-ETS regulations envisage the possibility of joint compliance, whereby possible excess emissions in the LULUCF sector can be offset by the reduction of additional emissions in the non-ETS sector and, in an opposite direction, the LULUCF sink can be used to offset non-ETS emissions, although in this case it is subject to a quantitative maximum, i.e. a maximum volume of offsetting provided for a Member State for 2021 to 2030, which in the case of Portugal will be 6.2 million tonnes equivalent of CO_2. At present, Portugal does not anticipate using this flexibility nor the need to offset emissions between the LULUCF sector and non-ETS sector or vice-versa. Emission credits for these sectors are also not expected to be acquired or sold.

In December 2018, Portugal submitted its draft to the European Commission concerning its forestry reference level for the 2021-2025 period. This was assessed by the Commission and experts from Member States, resulting in a series of suggestions and recommendations. The revised version of the original proposal is currently being prepared and will be submitted by 31 December 2019. It is expected to be implemented in the first half of 2020.

iii. Other national objectives and targets consistent with the Paris Agreement and existing long-term strategies Other objectives and targets, including sector targets and adaptation goals, which contribute to the overall commitment by the Union to reduce GHG emission

Notwithstanding the aforesaid commitments made at a community level, achieving carbon neutrality by 2050 means a significant reduction of emissions, based on a trajectory of reducing -45% to -55% by 2030, -65% to -75% by 2040 and -85% to -90% by 2050, as compared to 2005 levels. This represents a series of truly transformational challenges in the way how some of the most decisive aspects of life in society are viewed, particularly in relation to production and consumption patterns, relationships with the generation and use of energy, how cities and living, working and leisure spaces are designed and the how we get from one place to another and view mobility needs. Thus, for the time frame set out in this current Plan, the following national goals are also important.

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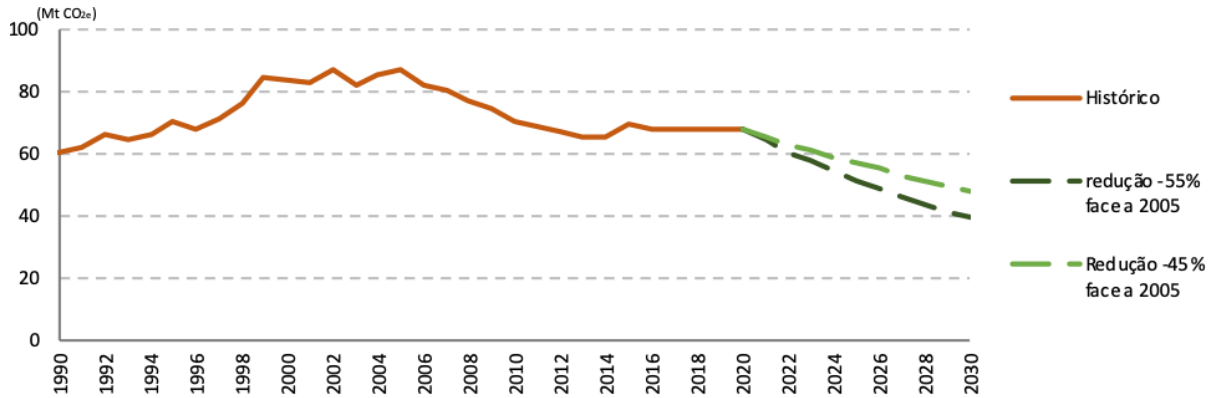
Table 6- National target for the reduction of CO2eq emissions (without LULUCF) with respect to 2005

	2020	**2030**
Other national targets	-18% to -23%	-45% to -55%

The following figure shows the trajectory to reducing total GHG emissions for the 2030 horizon, in keeping with the commitment to be carbon neutral by 2050.

Figure 14 – Evolution in GHG emissions and established reduction targets for the 2030 horizon (Mt CO2e)



Key

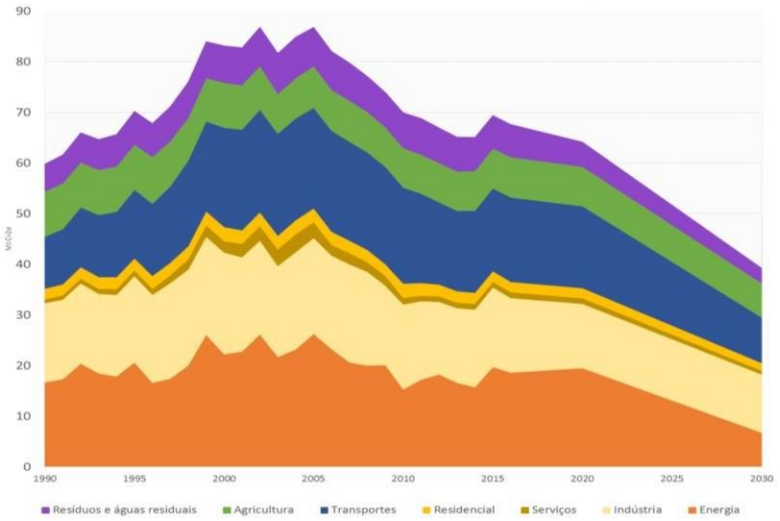
PT	EN
Histórico	Historic
Redução – 55% face a 2005	Reduction – 55% over 2005
Redução -45% face a 2005	Reduction -45% over 2005

As has been mentioned, the evolution of national emissions in different carbon neutral trajectories indicates highly significant decarbonisation of the national economy for the 2030 horizon and as such, it will be necessary to ensure that the various sectors of activity contribute toward this target. In this sense, all sectors have the potential to reduce emissions, although it is not the same for all sectors and GHG, in large measure, depend on the degree of maturity of the technologies and cost-effectiveness. Thus, it is expected that decarbonisation will be more accentuated over the next decade in the generation of electricity and the transport and building sectors. The following national goals were jointly defined on a sector level for the 2030 horizon (non-ETS sectors).

Table 7- National sector targets for the reduction of CO2e emissions with respect to 2005

	2020	**2030**
Services	-65%	-70%
Residential	-14%	-35%
Transport	-14%	-40%
Agriculture	-8%	-11%
Waste and Wastewater	-14%	-30%

Figure 15 – Evolution in GHG emissions by sector and established reduction targets for the 2030 horizon (Mt CO_{2eq})



Key

PT	EN
Resíduos e águas residuais	Waste and wastewater
Agricultura	Agriculture
Transportes	Transport
Residencial	Residential
Serviços	Services
Indústria	Industry
Energia	Energy

2.1.2. Objectives relating to renewable energy sources.

i. Contribution to the binding target of the Union of a minimum of 32% in renewable energy by 2030, as the share of energy from renewable sources in final gross energy consumption in 2030.

With regard to renewable energy, Portugal has strong arguments to continue to build a strategy based on renewable sources of energy on the path to a carbon neutral economy. Portugal's ambition and determination to be at the forefront of energy transition is reflected in ambitious but feasible goals for 2030. As such, Portugal's contribution toward the Union's binding goal of achieving at least 32% of renewable energy by 2030 in terms of the energy share of renewable sources in gross final energy consumption is one of the most ambitious at a European level.

Table 8- Indicative trajectory and contribution of Portugal to the binding Union target of 2030

	2020	2022	2025	2027	2030
Renewables in gross final energy consumption[11]	31%.	34%.	38%.	41%.	47%.

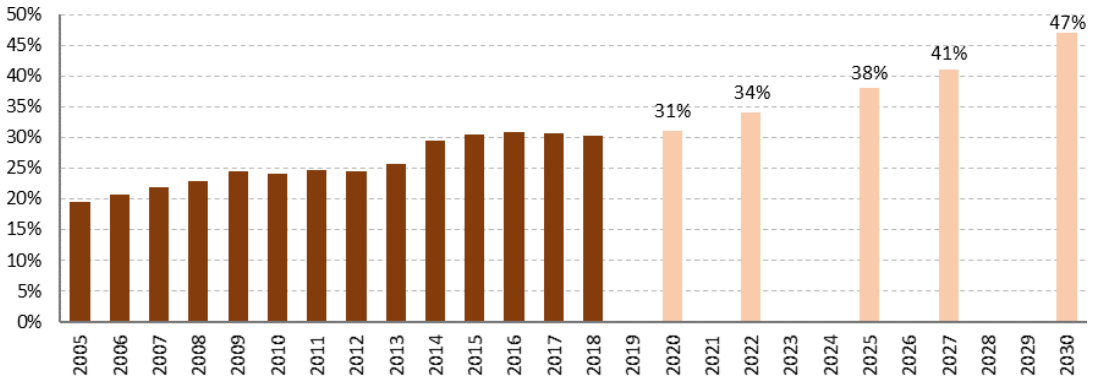
Portugal's goal for the share of renewable energy in the gross final energy consumption for 2030 reflects two essential aspects: i) the path it has already traversed in promoting RSE, which has made Portugal a leader at a European level; ii) the existing potential.

In particular, the main drivers were defined to achieve a 47% share for renewables in final energy consumption by 2030, with emphasis on the electrification of the economy and consumption, the evolution of installed capacity and the generation of electricity from renewable sources, increased penetration of electric vehicles and other solutions for sustainable mobility, the introduction of renewable gases and highly-efficient technologies in various sectors, research and innovation/maturing of alternative technologies to reduce costs.

[11] The indicative trajectory of the evolution of renewable energy in Portugal pertains to the reference points set out in the Regulation on the Governance of the Energy Union and Climate Action, more precisely Article 4(a)(2), which states that by 2022, 2025 and 2027 the indicative trajectory must achieve the reference points of at least 18%, 43% and 65% of the total increase of the energy share of renewable sources between the binding national goal for 2020 and for 2030.

The following figure shows the trajectory in the share of renewable energy sources in gross final energy consumption for the 2030 horizon.

Figure 16 – Evolution in the share of renewable sources in gross final energy consumption for the 2030 horizon



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

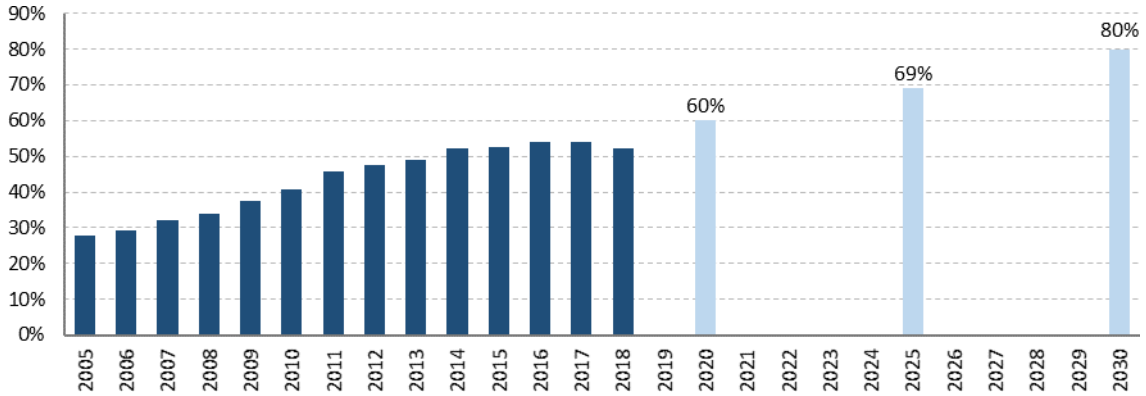
On a sector level, to comply with the overall RSE goal and based on the principal drivers that have already been defined to achieve this goal, the following national goals and targets were defined for the 2030 horizon.

Table 9- Estimated trajectories for the sector share of renewable energy in final energy consumption for the 2030 horizon

	2020	2025	2030
Electricity	60%	69%	80%
Heating and Cooling	34%	36%	38%
Transport	10%	13%	20%

In relation to the Electricity sector, there will be strong emphasis on electrifying the consumption associated with decarbonising production by reinforcing the use of renewable energies, with particular focus on solar and onshore/offshore wind technologies, while promoting distributed production and storage, reinforcing and optimising transport and distribution networks and promoting pilot projects (concentrated photovoltaic, stimulated geothermal and wave power). As has been mentioned, Portugal also has enormous potential to use endogenous resources to produce electricity and thus, to ensure compliance with the goals, the objective for the electricity sector includes reinforcing exploration of this potential.

Figure 17 - Evolution in the share of energy from renewable sources in electricity for the 2030 horizon



In this context, in relation to the generation of electricity, the following aspects are particularly worthy of note:

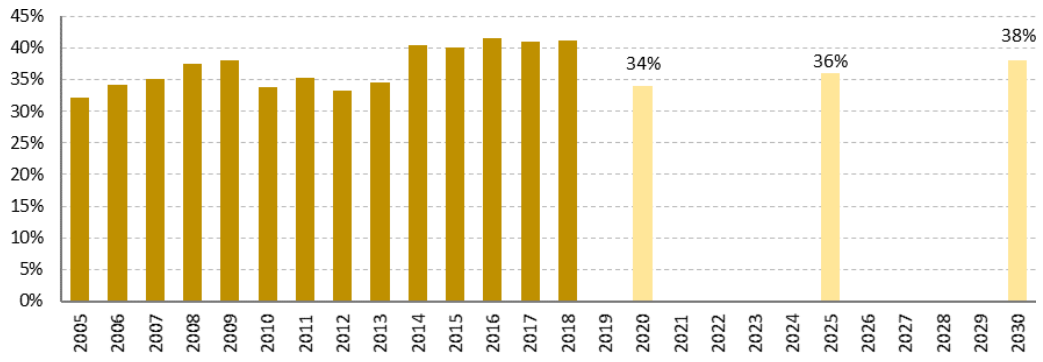
Hydroelectric	Reinforce the use of national potential for hydroelectricity, namely, by concluding the construction of the Alto Tâmega hydroelectric complex, consisting of three hydroelectric facilities – Gouvães (with pumping), Alto Tâmega (turbine) and Daivões (turbine) – that together represent 1.2 GW of new capacity and will similarly contribute toward improving supply security due to its pumping capacity. In the Autonomous Region of Madeira, reinforcing the use of hydroelectric potential will include expanding the Calheta hydroelectric plant.
Onshore wind energy	Portugal also has significant potential for wind power that has yet to be explored, while it is simultaneously important to pay attention to existing wind farms, providing them conditions to be more competitive. To this end, the strategy to reinforce onshore wind energy will include new equipment and repowering, creating the necessary conditions to make these options viable.
Solar Photovoltaic	A steep fall in the cost of technology and the extraordinary national potential to use the sun as a source to produce electricity mean that this will be a fundamental technology to meet targets. The two main instruments that will be used to accelerate the development of solar capacity in Portugal will be: (i) auctions to allocate network injection capacity and (ii) possibility of promoters to develop network expansions along with the network operator in situations where there is no reception capacity (ideally for large scale projects). Applying a logic of complementarity with centralised energy generation instruments, the promotion and dissemination of decentralised energy generation from renewable energy sources and energy communities are particularly relevant and will increase very significantly in the next decades.
Biomass	Forestry biomass is an important endogenous resource and hence using it for energy is one of the solutions that will contribute toward creating value in the forestry sector. However, using new thermoelectric power plants to exclusively generate electricity will tend to be abandoned, as it is not particularly efficient and has a low rate of return, which makes it necessary to have a guaranteed tariff with positive discrimination (above the market price) to recover associated investments.
Geothermal	The Autonomous Region of the Azores has the potential to reinforce its use of geothermal resources and the installed capacity could be increased with a view to achieving maximum production from available resources. Support could also be provided for pilot projects involving deep-sea geothermal energy, considering the reduced cost of drilling and the fact that it is a relatively easy technology to generate electricity.
Concentrated Solar Thermal	Pilot projects will be promoted based on concentrated photovoltaic (CPV) technologies as a technology that makes it possible to store energy.

Offshore wind energy	Promoting and using the infrastructure being created near Viana do Castelo, where investments have already commenced, with a view to achieving (in the first phase) 200 MW of new capacity, 25 MW of which has already been allocated to the Windfloat project. This investment aims to encourage national and international investors to maximise this infrastructure to promote offshore wind energy.
Waves	Portugal's potential to use wave energy is widely recognised and diverse measures have been initiated to expand the Ocean Economy, namely the installed capacity for wave power.
Hybrid systems	Promoting hybrid systems will provide greater flexibility for the system and greater efficiency using resources, considering the possibility of complementarity between forms/sources of energy (e.g. wind and solar), while simultaneously maximising the network connection capacity.
Coal	Electricity generation using coal is expected to be phased out by closing the two power plants that are currently operating in mainland Portugal – Pego and Sines – which will be permanently closed at the end of 2021 and 2023, respectively.
Natural gas	Will play an important role in the transition to an energy system based on renewable sources, functioning as a backup for the electricity-generation system, remaining in the system for the next two decades. A gradual reduction in its use is expected in the medium to long-term.

In relation to the Heating and Cooling sector, the role of fuel consumption in this sector is expected to reduce as energy efficiency measures and the electrification of consumption is reinforced. In this regard, it will be possible to increase the percentage of renewable energy through the greater use of biomass and renewable gases.

It is important to note that after the analysis carried out while preparing NECP, Portugal is one of the countries of the European Union where it may not be possible to increase the share of renewable sources of energy by 1.3% or 1.1% per year, as set out in Directive (EU) 2018/2001. However, considering that renewable gases, such as biomethane and hydrogen could play a more relevant role for the 2030 horizon, this perspective could change in the short to medium-term, after a more in-depth analysis of the potential of renewable gases in Portugal, which will take place over 2020-2021. Similarly, for the first time it was possible to account for the total contribution of renewable energy heat pumps in gross final energy consumption and therefore, during modelling, it was not possible to include data for heat pumps in this plan in the same way as they were accounted for to calculate the contribution of renewables in gross final energy consumption for the heating and cooling sector. This is why there is a difference between the historic data (2005-2018) and forecasts for this sector. This aspect will be revised in the updated version of NECP, which will be submitted to the COM at the end of 2024, to achieve higher levels of the incorporation of renewables in the heating and cooling sector.

Figure 18 - Evolution in the share of energy from renewable sources in heating and cooling for the 2030 horizon

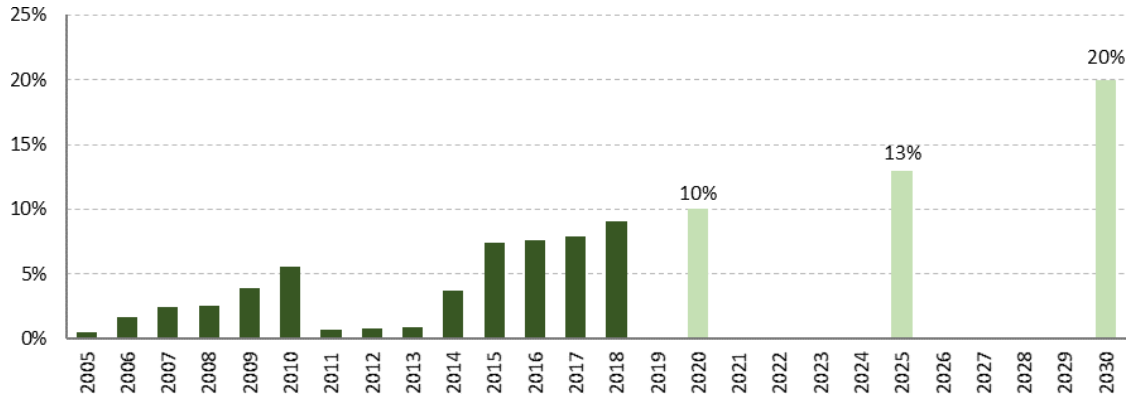


Increasing the incorporation of renewables in the heating and cooling sector and thus complying with the goals for this sector will include:

Biomass:	Forestry biomass is an important endogenous resource and as such, its use for energy is one of the solutions that will contribute toward creating more value in the forestry sector. The strategy includes decarbonising existing thermal consumption and promoting energy efficiency, namely by promoting the installation of small decentralised biomass thermal power plants (e.g. cogeneration), on a small scale, which does not place as much pressure in terms of availability of biomass and on the energy system.
High-efficiency cogeneration	High-efficiency cogeneration using renewable sources of energy makes it possible to achieve significant energy savings, being used preferably in industries that consume energy intensively. New studies on potential will seek to determine energy needs precisely that can be satisfied in a circular economy and identify economic and legislative barriers.
Renewable gases	Renewable gases, particularly biomethane and hydrogen, are a viable alternative for substituting fossil fuels in the heating and cooling sector. The renewable gases regulation and their introduction into networks transporting and distributing natural gas will make a significant contribution.
Heat pumps	In the residential and services buildings sector, along with other efficient solutions, heat pumps are one of the most efficient forms of heating and cooling, contributing toward increased comfort and reinforcing the electrification of consumption.
Solar thermal	In buildings, solar thermal energy will coexist with other technologies that have great potential and efficiency, such as biomass boilers and heat pumps. It will nonetheless continue to play a significant role in heating hot water and, along with other efficient solutions, is one of the most efficient forms of heating spaces and water, contributing toward increased comfort. In the case of industry, the capacity to satisfy low/medium-temperature heat requirements will grow substantially.
Urban thermal networks	Based on the studies and analyses that have been carried out, it was felt that this is not a good option, considering Portugal's climate and as such, new developments are not envisaged in the next decade.

With respect to the Transport sector, there will be an emphasis on sustainable mobility and the decarbonisation of energy consumption, the promotion and reinforcement of public transport, emphasising complementarity and modal coordination, a strong push for electric mobility, the promotion of more energy efficiency measures, which have a greater impact, and the promotion of advanced biofuels and hydrogen.

Figure 19 - Evolution in the share of energy from renewable sources in transport for the 2030 horizon



Increasing the incorporation of renewable energy in the transport sector and thus ensuring compliance with the goal for this sector will include:

Electric mobility	Electric mobility, with particular emphasis on road transport, will be fundamental to ensure the progressive substitution of fossil fuels and promote greater incorporation of renewable sources in energy consumption. The introduction of electric vehicles will be promoted and supported and the charging infrastructure will be reinforced at various levels.
Advanced biofuels and Hydrogen	Advanced biofuels and hydrogen are an alternative solution and a complementary measure to electric mobility, particularly for the long-distance heavy goods road transport sector, heavy road passenger transport and passenger rail transport, the maritime freight sector and aviation, to leverage the decarbonisation of consumption and promote increased consumption of renewable sources of energy.

iii. Estimated trajectories per renewable energy technology that the Member State expects to use to comply with general and sector trajectories for renewable energy between 2021 and 2030[12]

Considering the forecast evolution of the electricity generation sector in Portugal, the following table shows the evolution of expected installed capacity, broken down according to technology, for the 2030 horizon for the purpose of meeting the targets set out for this sector, with an impact on other sectors.

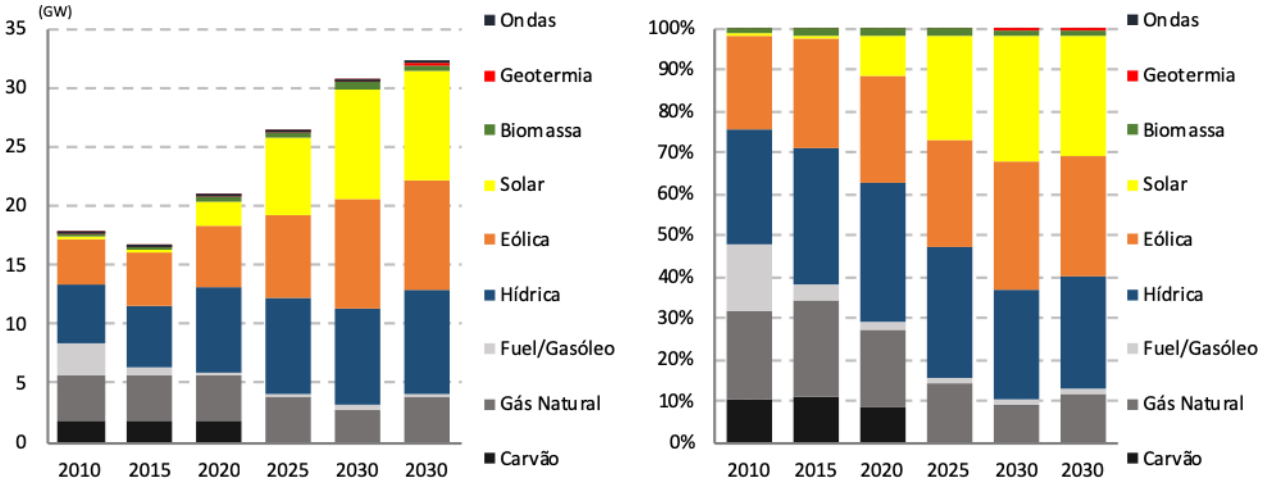
Table 10 - Perspectives for the evolution of installed capacity for the production of electricity per technology in Portugal for the 2030 horizon

(GW)	**2020**	**2025**	**2030**
Hydro	7.0	8.2	8.2 - 8.7
of which in pumping	*2.7*	*3.6*	*3.6 – 4.1*
Wind	5.4	6.8	9.3
Onshore wind energy	5.4	6.7	9.0
Offshore wind energy	0.03	0.1	0.3
Solar Photovoltaic	2.0	6.6	9.0
of which is centralised	1.5	5.8	7.0
of which is decentralised	0.5	0.8	2.0
Concentrated Solar Thermal (CSP)	0	0.1	0.3
Biomass:	0.4	0.4	0.5
Other renewables	0.03	0.06	0.1
Geothermal	0.03	0.03	0.06
Waves	0.001	0.03	0.07
Coal	1.8	0	0
Natural gas	3.8	3.8	2,8 – 3,8
Fuel/Diesel	0.4	0.3	0.3
TOTAL	**20.8**	**26.3**	**30,5 – 32,0**

NOTE: Does not include cogeneration

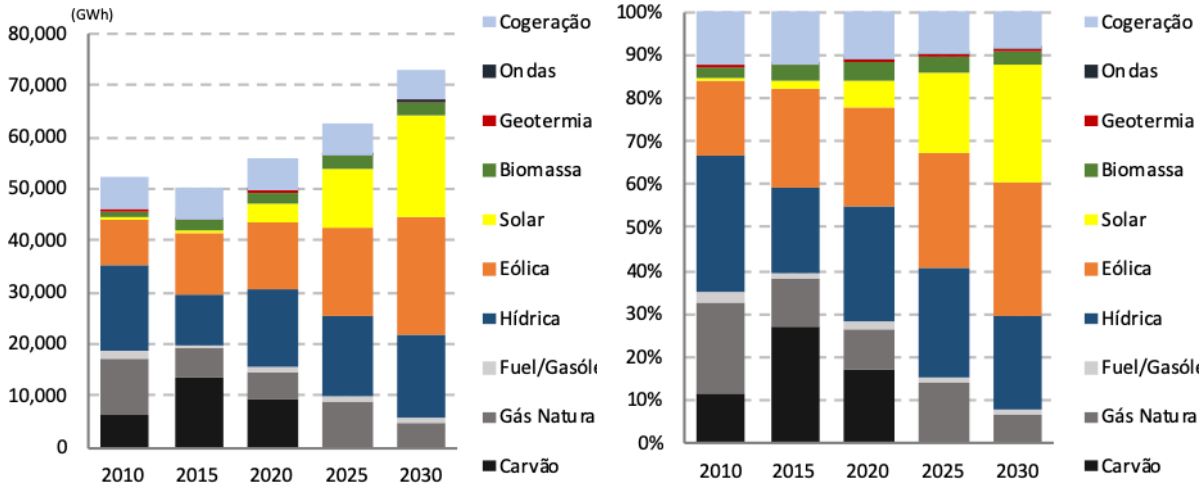
[12] Including expected final gross energy consumption, by technology and sector in Mtoe, and the total planned installed capacity (divided by new capacity and re-powering) by technology and sector, in MW

Figure 20 – Estimated installed capacity for the production of electricity by technology in Portugal for the 2030 horizon



Considering the forecast evolution of the electricity generation sector in Portugal, renewables are expected to contribute at least 80% of electricity generation by 2030, with emphasis on hydroelectricity, accounting for around 22%, wind energy, accounting for around 31% and solar energy, accounting for around 27%, the latter being the technology that will increase the most in the next decade.

Figure 21 – Estimated evolution of electricity production per technology in Portugal for the 2030 horizon



Key

PT	EN
Cogeração	Cogeneration
Ondas	Wave
Geotermia	Geothermal
Biomassa	Biomass
Solar	Solar
Eólica	Wind
Hídrica	Hydro
Fuel/Gasóleo	Fuel oil/Diesel
Gás natural	Natural gas
Carvão	Coal

In light of the forecast evolution of the heating and cooling sector in Portugal, the following table shows the expected evolution broken down by technology and energy sources for the 2030 horizon for the purpose of complying with the targets set out for this sector.

Table 11 - Perspectives for evolution in the consumption of renewable energies in the heating and cooling sector per technology in Portugal for the 2030 horizon

(ktoe)	**2020**	**2025**	**2030**
Biomass:	963	965	953
Heat pumps	101	102	102
Solar Thermal Heating	91	89	86
Heat from cogeneration	650	655	677
Renewable gases	0	12	50
TOTAL	**1 805**	**1 824**	**1 868**

In light of forecasts for the evolution of the transport sector in Portugal, the following table shows the expected evolution, broken down by energy source, for the 2030 horizon for the purpose of complying with the targets set out for this sector.

Table 12- Perspectives for the evolution of renewable energy consumption in the transport sector by technology in Portugal for the 2030 horizon

(ktoe)	**2020**	**2025**	**2030**
1st Generation biofuels	393	255	136
Advanced biofuels	-	94	155
Renewable hydrogen	-	9	65
Electricity	44	208	543
GRAND TOTAL	**437**	**566**	**900**

iv. Estimated trajectories on bioenergy demand, broken down into heat, electricity and transport, and on biomass supply by feedstocks and origin (distinguishing between domestic production and imports). For forest biomass, an assessment of its source and impact on the LULUCF sink

A breakdown of demand for bioenergy is shown in the following table.

(ktoe)	**2020**	**2025**	**2030**
Electricity	980	1 280	1 990
Heating and Cooling	1 613	1 632	1 680
Transport	393	349	291
GRAND TOTAL	2 986	3 261	3 961

v. Other national trajectories and objectives, including long-term or sector trajectories[13]

Not applicable.

[13] For example, the renewable energy share in urban heating networks, renewable energy use in buildings, renewable energy produced by cities, communities and self-consumers, the energy recovered from sludge obtained in waste water treatment

2.2. Dimension Energy efficiency

i.1 The indicative national energy efficiency contribution to achieving the Union's binding energy efficiency target of 32.5 % by 2030[14]

The Energy Efficiency Directive (EED) set a target of a maximum limit for the consumption of Primary or Final Energy by 2030 on the basis of forecasts by the 2007 PRIMES model, which is the last COM modelling exercise that did not consider energy efficiency plans and used 2005 as the reference year. The target is equivalent to a reduction of 32.5%, by implementing measures to promote energy efficiency.

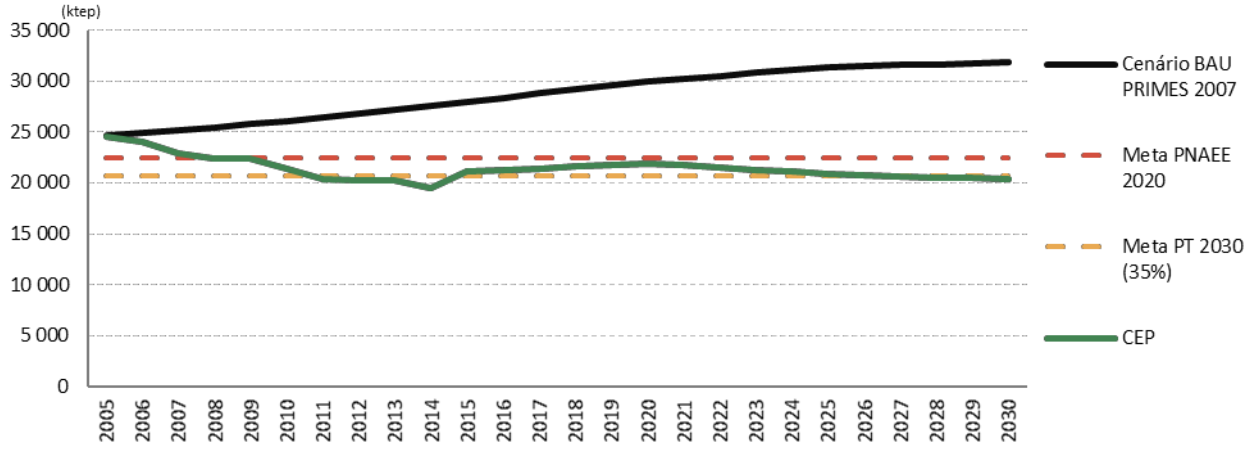
Just as Portugal showed high levels of ambition and determination to be at the forefront of energy transition by focusing strongly on renewables, energy efficiency also plays a relevant role for the 2030 horizon.

Table 13- The indicative national energy efficiency contribution to achieving the Union's binding energy efficiency target of 32.5% by 2030

	2020	2030
Reduction in primary energy consumption target[15]	25%	35%

The primary energy consumption estimate for the 2030 horizon makes it possible to view compliance with the goal of reducing energy consumption by 35%, as compared to the EU Reference Scenario of 2007 (PRIMES model). This is Portugal's indicative contribution to energy efficiency for complying with the goal of 32.5% energy efficiency for the Union in 2030.

Figure 22 - Indicative trajectory for the indicative national energy efficiency contribution to achieve the Union's binding energy efficiency target of 32.5% by 2030 (Primary Energy Consumption without non-energy uses)



KEY

PT	EN
Cenário BAU PRIMES 2007	**BAU PRIMES 2007 Scenario**
Meta PNAEE 2020	**PNAEE 2020 target**
Meta PT 2030	**PT 2030 target**
CEP	**PEC**

The contribution in terms of absolute level of primary energy consumption and final energy consumption in 2020 and 2030 is shown in the following table.

[14] Target referred to in Article 1(1) and Article 3(4) of Directive 2012/27/EU [version amended in accordance with the provisions of proposal COM(2016) 761], based on primary or final energy consumption, in the primary or final energy economies or on energy intensity.

[15] Excludes non-energy uses.

Table 14 - The indicative national energy efficiency contribution to achieving the Union's binding energy efficiency target of 32.5% by 2030 (Mtoe)

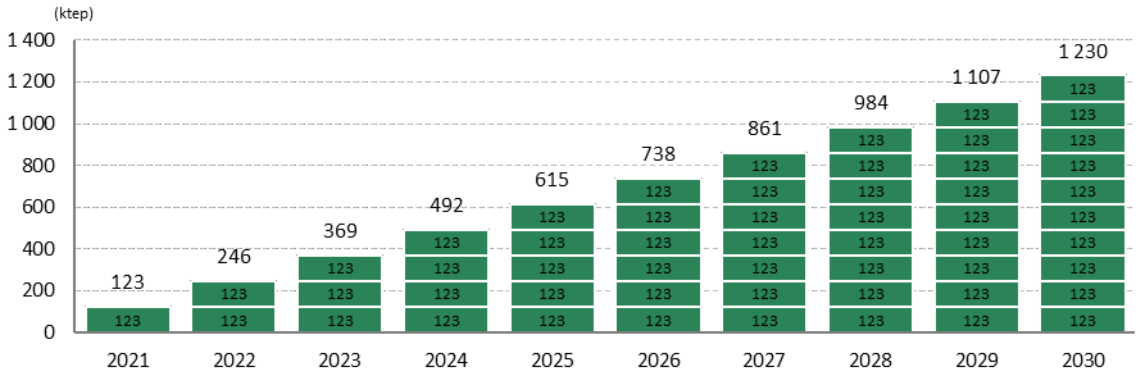
(ktoe)	**2020**	**2030**
Primary Energy Consumption[16]	22.6 – 19.6	21.5 – 15.6
Final Energy Consumption	15.4 – 15.6	14.4 – 14.9

i.2. Accumulated energy savings to be achieved from 2021-2030[17]

Article 7 of the EED directs all Member States to achieve cumulative savings of final energy, equivalent to new annual savings, from 1 January 2021 to 31 December 2030, of 0.8% of the average annual consumption of final energy of the last three years prior to 1 January 2019. As such, average final energy consumption was calculated for 2014 to 2016, resulting in a total saving of 6 739 682 toe in the period 2021-2030. This amount of savings is also a goal to be achieved in terms of implementing the aforesaid Article 7 of the EED.

The following figure shows accumulated energy savings to be achieved from 2021 to 2030 as a result of the abovementioned article.

Figure 23 - The cumulative amount of energy savings to be achieved over the 2021-2030 period under Article 7 of Directive 2012/27/EU



Ensuring compliance with the goals and targets for energy efficiency will include:

Renovating buildings and NZEB	Rehabilitating and making buildings more efficient makes it possible to achieve multiple objectives (e.g. reducing energy bills, improving comfort levels), and as such, the energy renovation of buildings is particularly relevant and a priority action. In this regard, the transposition of the amendments to the EPBD Directive (Energy Performance of Buildings Directive), the new energy certification, the review of the Energy Certification System (SCE) and redesigning mechanisms to fund/support the renovation of buildings are particularly relevant. Furthermore, NZEB (Nearly Zero Energy Buildings) buildings are increasingly important, since they have low or negligible energy needs for air-conditioning systems.
Mobility and Transport	The path to energy transition and carbon neutrality undoubtedly includes the transport sector. A combination of active and shared mobility, reinforcing public transport and electric mobility will all confer significant benefits in terms of energy efficiency in the transport sector.

[16] Excludes non-energy uses

[17] Due to Article 7 on the energy saving obligations of Directive 2012/27/EU [version as amended in accordance with proposal COM(2016)761]

Industry	Promoting the decarbonisation of the industrial sector includes focusing on greater efficiency, use of less resources and a circular economy, optimising as far as possible the nexus of energy, water and material efficiency in manufacturing processes while also ensuring increased productivity and competitiveness.
Agroforestry	There is a clear opportunity in this sector to create new avenues for improvements in energy consumption, with a view to promoting rational energy use in facilities and processes, contributing toward cost reduction. More efficient agricultural and forestry practices will be promoted, along with the acquisition and use of management tools and the installation and use of more efficient technologies.
Equipment	Electric equipment, particularly in the domestic and services sector, represents a significant share of energy consumption and it is thus important to make current equipment more efficient by promoting its substitution.

i.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[18]

The long-term strategy is currently being developed for the renovation of the national stock of residential and non-residential buildings, both public and private, in accordance with Directive 2018/844 of the European Parliament and of the Council of 30 May 2018, amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency. As such, the indicative targets of the strategy, more specifically with regard to renovated area and energy savings, have not yet been defined. These targets will form part of the strategy which, in accordance with Directive 2018/844, are to be defined by 31 March 2020.

i.4 Total area of construction to be renovated or equivalent annual energy savings to be achieved from 2020 to 2030 to promote the exemplary role of public buildings[19]

As mentioned, the long-term strategy is currently being developed for the renovation of the national stock of residential and non-residential buildings, both public and private, in accordance with Directive 2018/844 of the European Parliament and of the Council of 30 May 2018, amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency. The indicators to be created for 2030, 2040 and 2050 will reflect the contribution of the measures identified in the strategy to achieve the energy efficiency objectives.

ii. The indicative milestones for 2030, 2040 and 2050, the domestically established measurable progress indicators, an evidence-based estimate of expected energy savings and wider benefits, and their contribution 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, (public and private)[20]

As mentioned, the long-term strategy is currently being developed for the renovation of the national stock of residential and non-residential buildings, both public and private, in accordance with Directive 2018/844 of the European Parliament and of the Council of 30 May 2018, amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency. The indicators to be created for 2030, 2040 and 2050 will reflect the contribution of the measures identified in the strategy to achieve the energy efficiency objectives.

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

Not applicable.

[18] In accordance with Article 2-A of the Directive revising Directive 2010/31/EU on the energy performance of buildings

[19] Due to Article 5 of Directive 2012/27/EU

[20] In accordance with Article 2A of Directive 2010/31/EU

2.3. Dimension Energy security

i. national objectives for the diversification of energy sources and supply from third countries, for the purpose of increasing the resilience of regional and national energy system

Diversification of energy sources must be fostered from a perspective of supply security and is a national objective. As Portugal does not have natural gas or oil, it focuses on the development of endogenous renewable energy resources, and incentives have been provided in this regard. The results of this policy are reflected in the gradual reduction in energy dependency which has been seen over the last 10-15 years.

Although specific objectives have not been defined for supply by third countries, with regard to the gas and oil sectors, Portugal has a diversified portfolio of suppliers and origins of these products (Chapter 4), which is to be consolidated, given that the most recent studies/assessments show a good level of supply security brought about by such diversification. The increase in recent years of underground storage capacity at Carriço and the tanks at the Sines LNG Terminal have also contributed to the diversification of sources supplying natural gas to Portugal.

In the case of electrical power, the diversification of external origins is more limited for geographical reasons, and as such, the focus is mainly on the diversification of internal production (focus on renewable production, exploiting the potential that exists in Portugal). However, equally high importance is also given to external origins with emphasis on reinforcing interconnections with Spain, which will allow improved balancing in the NES and consequently, better supply security.

Finally, it is important to note that the diversification of sources and energy resource supply routes is crucial for the safety of supplies, without, however, undermining decarbonisation targets.

ii. 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

Energy security is achieved by guaranteeing the security of supplies, which must also consider decarbonisation targets, based on specific characteristics of energy systems while simultaneously increasing their resilience. A parallel objective is to improve the diversification of energy sources, the complementary use of renewable resources and guaranteed supplies by third countries, without, however, undermining decarbonisation targets.

This also entails focusing on developing energy storage solutions, which will help reduce Portugal’s energy dependence on external sources in the medium and long-term.

To this end, Portugal will continue to reduce its energy dependence on external sources, pursuing its current trajectory of reduced energy dependence. Portugal’s objectives for 2030 include renewed emphasis on using endogenous renewable energy resources as well as on energy efficiency.

Table 15- Portugal's objective to reduce energy dependency for the 2030 horizon

	2030
Energy dependency	65%

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

National objectives for implanting domestic energy sources:

Portugal will continue to focus on developing a highly decarbonised electricity-generation sector, considering the availability of endogenous renewable resources, such as water, wind, solar, biomass and geothermal energy. It has developed a safe and reliable electricity system that is capable of dealing with the variability that increased focus on renewables introduced, which will undergo important evolution over the next decade. There will be a renewed drive to explore the potential of renewable energies in the 2030 time frame, with special emphasis on solar and onshore/offshore wind technologies. Distributed generation and pilot projects will also be promoted (concentrated photovoltaic, stimulated geothermal and wave energies).

National objectives to increase storage

The existence of storage systems in different forms is considered to be fundamental and crucial to ensure better management of the national energy system in its various sub-sectors, as a tool promoting the flexibility and stability of the national electricity system.

It is thus important to continue to focus on reversible pumping systems in hydroelectric plants and to try and develop other technological solutions, which include using battery and hydrogen technologies. A significant share of the new storage capacity will be directly associated with renewable electricity generation centres.

In the case of electrical power, storage is seen as a tool for the flexibility and stability of the NES.

Storage capacity is expected to increase by 2030, fundamentally by means of reversible hydroelectric pumping facilities and, later in the decade, through a contribution by battery and hydrogen technologies. A significant part of this capacity is associated with generation facilities via wind and solar technologies while the remainder is dedicated storage.

With regard to objectives for energy storage in the natural gas and oil and oil derivatives sectors, national rules exist arising from Community legislation to create security reserves with a view to being able to respond to crisis situations or in the event of supply emergency/disruption in such products. Current underground capacity at Carriço allows all natural gas security reserves for the coming years to be stored.

National objectives to increase demand response

With regard to demand response in the electricity sector, also considered in the evolution of demand are energy savings resulting from existing and planned efficiency measures and consumption requirements, taking into account forecasts for increased electrical vehicle use.

Industrial facilities will be relevant in the electricity sector as will incentives for 'behind-the-meter' storage in the building sector and industrial sector, so as to make daily variations in the public service electricity network load less accentuated. 'Smart' strategies for charging electric vehicles will also become more generalised.

Using the Annual Supply Security Monitoring Reports for the electricity and natural gas sectors as a basis for the electricity and natural gas sectors (RMSAs), the aim is to achieve a balance between existing and expected supply and demand for the 2030-2040 horizon. Taken into consideration in expected supply are new installation licensing processes and guidelines on energy policy (new installations and decommissioning of existing installations).

2.4. Dimension Internal Energy Market

2.4.1. Electricity interconnectivity

Electricity interconnectivity is essential to ensure the better functioning and development of the internal energy market, along with improvements in managing and digitalising the electricity system and making it more flexible. Interconnectivity ensures both increased competition, stability in energy markets as well as the integration of markets. In its conclusions of 23 and 24 October 2014, the European Council approved a Climate and Energy Framework for 2030 for the Union, based on four main goals, including a goal of 15% for electricity interconnections. This goal was set out in the Regulation on the Governance of the Energy Union and Climate Action and Portugal is committed to achieving it.

Regional cooperation is similarly relevant in this context and will be reinforced to promote closer ties among Member States, with special emphasis on Spain and France, with a view to monitoring and assessing interconnection projects that meet the need for interconnectivity in energy markets and systems.

Table 16 - Portuguese target for electricity interconnections

	2020	**2030**
Target for electricity interconnections	10%	15%

2.4.2. Energy transmission infrastructure

i. Key national objectives for electricity and gas transmission infrastructure, and if required, modernisation projects that are necessary for the achievement of objectives and targets under any of the five dimensions of the Energy Union Strategy

To meet European commitments, based on national energy policy with respect to internal market integration and supply security, and with the aim of achieving more robust, efficient and interconnected national electricity and gas systems, Portugal is planning to develop the respective transmission and distribution networks. Currently underway are projects which contribute to this goal which are recognised by the European Commission as having a relevant role in internal market integration, supply security and also with respect to economic sustainability.

Key gas transmission infrastructure projects (to be implemented by 2030)

In the priority corridor 'North-South Natural Gas Interconnections in Western Europe (NSI West Gas)' the following projects are planned:

- Interconnection PT-ES (3rd interconnection) – 1st phase

The Project of Common Interest (PCI) for the gas sector relating to the Celorico – Vale de Frades gas pipeline, first stage of the future 3rd interconnection between Portugal and Spain, is directly dependent on the completion of the PCI South Transit East Pyrenees ('STEP'), corresponding to the 1st stage of the future interconnection between Spain and France. It should be noted that the abovementioned interconnection projects (Portugal – Spain and Spain - France) are also defined in the Madrid Declaration Implementation Plan.

Key electricity transmission infrastructure projects (to be implemented by 2030)

For 2021-2030, the following projects are planned in Portugal in the priority corridor 'North-South Electricity Interconnections in Western Europe (NSI West Electricity)':

- 2.16 Total internal lines
  - 2.16.1 Internal line between Pedralva and Sobrado (PT), former 'Pedralva and Alfena (PT)'
  - 2.16.3 Internal line between Vieira do Minho, Ribeira de Pena and Feira (PT), former 'Frades B, Ribeira de Pena and Feira (PT)'
- 2.17 Portugal-Spain Interconnection:
  - Portugal — Spain interconnection between Bearіz — Fontefría (ES), Fontefria (ES) — Ponte de Lima (PT) (formerly Vila Fria/Viana do Castelo) and Ponte de Lima — Vila Nova de Famalicão (PT) (formerly Vila do Conde) (PT), including substations in Bearіz (ES), Fontefría (ES) and Ponte de Lima (PT)

A new interconnection between the electricity transmission networks of Portugal and Spain in the Minho region will allow a minimum commercial interconnection capacity of 3 000 MW to be achieved, in both directions (ES > PT and PT > ES).

Furthermore, the current proposed National Electrical Power Transmission Network Development Plan for 2018-2027, presented by the TSO in March 2017 sets out a series of network reinforcements (including the 400-kV Falagueira-Fundão axis, the 400-kV Falagueira-Estremoz-Divor-Pegões axis and the 400-kV Ferreira do Alentejo-Ourique-Tavira axis) which will allow network capacity to be created for new renewable energy power plants.

In order to facilitate the connection of the future Tâmega waterfall dams (Gouvães, Daivões and Alto Tâmega - with 1 158 MW total power and 880 MW pumping capacity) the 400-kV line will be finalised linking the current Vieira do Minho step-down station with the future Ribeira da Pena substation, and its extension to the current Feira substation.

It is also important to note that the Electricity Transmission and Distribution Network Operators (REN and EDP Distribuição) will be oriented so that their future proposals for Network Development and Investment Plans (PDIRT and PDIRD) are aligned with the national goals and targets set out in this Plan, including identifying the necessary investments in the network. In this regard, the criterion of economic rationality will always be upheld while implementing the changes that are essential to comply with the goals and targets defined herein for 2030.

Main infrastructure projects (trans-European) envisaged other than Projects of Common Interest (PCIs)[21]

In order to achieve the objectives set out in this point of the plan for the 2021-2030 time frame, other infrastructure projects may be considered in the electricity and gas sectors deemed to be equally relevant:

- Of note in the electricity sector are the projects to reinforce internal networks (transmission and distribution) to connect and accept renewable power production (to achieve national potential in this type of electrical power production).
- Moreover, depending on the evolution seen in the Portuguese and Spanish electricity systems, more specifically with regard to renewable power generation, it will be necessary to assess, in addition to possible network reinforcement, the need for new interconnections;
- Planned for the gas sector are projects which could increase the use of LNG and improve LNG reception capacity at the Sines Terminal, to strengthen Portugal's role as an 'entry point' for natural gas into the

[21] In accordance with Regulation (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)

internal market/European gas system.

The Strategy to Increase the Competitiveness of the Mainland Commercial Port Network - Horizon 2026, approved by Council of Ministers Resolution No 175/2017 sets out a strategic vision based on fundamental pillars, more specifically consolidating Portugal's position as a hub for LNG in the Atlantic. There is a clear focus on innovation in green shipping so as to transform the Portuguese port system into a 'service area' for the supply of LNG vessels and into an LNG re-exporting hub.

This aim can be achieved through conventional onshore terminal solutions (as with the terminal in Sines), onshore small-scale (as is the case in the port of Rotterdam) or floating offshore bunkering (ship-to-ship, LNG transfer between vessels). This series of capacities will reinforce Portugal's role as an LNG re-exportation hub, actively contributing to establishing a European energy corridor, promoting economic activity related to LNG trading, ship building and related engineering services.

2.4.3. Market integration

i. National objectives related to other aspects of the internal energy market such as market integration and coupling[22], including a timeframe for compliance with objectives

Not applicable.

ii. National objectives related to the non-discriminatory participation of renewable energy, demand response and storage, including via energy aggregation, in all energy markets, including a timeframe for compliance with objectives

Not applicable.

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

In February 2018, ERSE approved the rules for implementing, as of 1 June 2018, two pilot-projects, including the introduction of dynamic tariffs for access network access in mainland Portugal. Participation in the pilot-projects, intended only for industrial consumers, is voluntary and will cover 100 consumers per pilot-project, over 12 months. Based on the results of the pilot-projects, ERSE will conduct a cost-benefit analysis to assess the merits for the electricity system and the possible setting of specific targets for installing smart meters.

To promote distributed production and self-consumption of power from renewable sources, a new legal framework was developed, Decree-Law No 162/2019 of 25 October 2019, which: (i) allows and promotes individual self-consumption; (ii) allows the forming of energy communities. The legal establishing of these activities will allow individuals, companies and other public and private entities to produce, consume, share, store and sell energy produced from renewable sources, thus actively participating in energy transition.

For its obvious advantages, but also in relation to the challenges it presents, the promotion of self-consumption of renewable energy, whether individually or collectively or through energy communities, will be accompanied by an information and support programme for implementing self-consumption projects. The aim is to reduce information asymmetries and support companies, municipalities and citizens in the development of such systems.

Of special note among the initiatives to be implemented are the support programmes for establishing self-consumption in partnership with municipalities. These programme(s) aim to support the establishment of the aforesaid projects, both technically as well as with a view to obtaining funding. Support will be provided through public entities qualified for the purpose in partnership with agencies and local partners. Self-generation projects

[22] Such as an increase in system flexibility, particularly in relation to the competitive setting of prices in line with applicable sector law, market integration and coupling to increase the commercial capacity of existing interconnections, smart networks, aggregation, demand response, storage, distributed production, dispatch mechanisms, re-dispatch and load shedding and real time price signalling

will be established in the short term, particularly in municipalities in the interior regions and for consumers suffering from energy poverty.

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

National objectives with regard to ensuring the adequacy of the electricity system

With regard to ensuring the adequacy of the electricity system, the NES Supply Security Monitoring Report (RMSA-E) sets out supply security indicators. Supply security in relation to the production of electricity is linked to the performance of the electricity production system in two ways: *adequacy* (static assessment of the installed capacity to meet hourly electricity demand), and *security* (operational analysis with assessment of system response capacity to disruptions in the supply - demand balance).

Supply security conditions on the RMSA-E timeline are assessed through probabilistic indicators resulting from the simulation of configurations of the electricity production system with the RESERVAS model, which reflect its performance in the two aspects mentioned above. This model is applied by the TSO in collaboration with DGEG when drawing up the RMSA-E:

i) Adequacy

Assessing the adequacy of the available power to meet hourly demand is carried out using the 'Peak Probabilistic Coverage Index' (ICP), which corresponds to the smallest of the twelve monthly ICPs of each year. In this analysis, a contribution of capacity corresponding to 10% of the planned Net Transfer Capacity (*NTC*) is considered. To verify the adequacy of the system's capacity to cover peak consumption, the ICP with probability of surplus between 95% and 99% must not be less than 1.0.

ii) *Security*[23]

The operational reserve requirements are assessed on the basis of the deviations in supply and demand balance occurring between all incremental periods. Those requirements are addressed with the existing production resources each year that are capable of supplying the operational reserve. The operational reserve is made up of the secondary and tertiary reserves up to an hour.

To assess overall security of supply levels for configurations of the national electricity generating system under analysis the LOLE indicator is used (Loss of Load Expectation*),* which is calculated by the RESERVAS model incorporating the loss of load expectation associated with the *Adequacy* component (static LOLE) and the loss of load expectation due to inadequate operational reserve – *Security component.* In the analysis of security of supply, in accordance with studies carried out by the TSO, this indicator should be not more than 5 (h/year).

National objectives with regard to ensuring energy system flexibility

With the growing integration of renewable power production installations into the NES, it is now vital to create mechanisms providing the System Manager with greater real time monitoring of such production and that flexibility mechanisms are built into this production.

In light of the above, by 2022 all production installations with more than 1 MW of installed power and which are connected to transmission and distribution networks are required to implement means of communication to receive real time interruption or reduction instructions from the System Manager relating to the injection of energy produced by them. For this purpose, the production facility is required to have at its disposal all of the communication, metering and control mechanisms necessary so that it may receive System Manager interruption or reduction instructions directly or via a dispatch centre linked to the producer facility.

This requirement must be implemented as quickly as possible for production facilities of more than 1 MW which

[23] Of note with regard to the *Security* aspect is that only the disruptions in the stationary regime of the system are analysed (sufficiency of secondary and tertiary reserves). The dynamic analysis of the system is therefore not contemplated (in the transitory regime).

are not connected to transmission and distribution networks.

Interconnection capacity among the different European systems leads to an increase in system flexibility, which is normally associated possible exchange of reserves to satisfy imbalances between the supply and demand of electricity.

A part of the new hydroelectric projects equipped with storage capacity and reversibility (functioning as pumping) that are scheduled to become operational by 2026 (Gouvães with reversibility, Daivões and Alto Tâmega) will make an important contribution toward increasing the system's flexibility in terms of integrating intermittent renewable production, as this type of technology provides an operational reserve for rapid mobilisation (rising and falling reserves).

The adequacy of the Portuguese electricity system (medium/long-term assessment) with regard to flexibility corresponds to the supply security assessment referred to in previous point.

v. National objectives to protect energy consumers and improve the competitiveness of the retail energy sector

National objectives to protect energy consumers

At this stage of development of the plan, no specific objectives or targets exist in this regard. However, of note is the strategic objective in NECP to ensure fair, democratic and cohesive transition, reinforcing the role of the citizen as an active agent in decarbonisation and in energy transition. This will create equitable conditions for all, fighting energy poverty and providing instruments to protect vulnerable citizens while promoting their active involvement and territorial enhancement.

It is important to note that the energy sector and climate questions are complex and often communicate in a language that is not understood by everyone, and as a result, citizens are not aware of the options available to them. This is why it is crucial to promote energy literacy for consumers through more transparent information and to ensure greater knowledge on energy and climate, allowing citizens to make more informed choices and promote more and better information for consumers, contributing toward transparency and competition in the energy market. A better-informed consumer represents better, more efficient and sustainable choices and a consumer at the centre of decision making is a more active consumer in energy transition, and one which is available to participate in the structural changes required to meet this challenge.

Therefore, measures will be implemented to promote information for consumers and companies, contributing toward better energy literacy and simplifying interaction with the market.

2.4.4. Energy poverty

i. National objectives with regard to energy poverty, including a timeline for compliance with objectives

At this stage of development in the plan, no specific objectives or targets exist in this regard. However, of note is the strategic objective in NECP to ensure fair, democratic and cohesive transition, reinforcing the role of the citizen as an active agent in decarbonisation and in energy transition. This will create equitable conditions for all, fighting energy poverty and providing instruments to protect vulnerable citizens while promoting their active involvement and territorial enhancement.

Measures aimed at combatting energy poverty and improving instruments to protect vulnerable clients will be instituted. For this purpose, a long-term strategy will be developed to combat energy poverty, the main objective of which is to diagnose and characterise the problem, develop monitoring indicators, monitoring strategies and targets to reduce energy poverty in the medium and long-term, on a national, regional and local scale, and to propose specific measures to achieve these targets, as well as forms of funding.

After these short-term measures have been completed, the measures to fight energy poverty will be defined thus providing benefits which ensure the supply of electricity to vulnerable customers or support to improve the energy efficiency of homes.

2.5. Dimension Research, innovation and competitiveness

i. National objectives and funding targets for public and private research and innovation in the public and private sectors

Portugal is committed to developing actions that ensure it is a leader in terms of the penetration of renewable energy sources and new low-carbon technological solutions to promote decarbonisation of the economy and achieve the goals set out for 2030 within the scope of this Plan.

Promoting research, innovation and competitiveness (R&I&C) to support the implementation of NECP is essential for the success of the plan, which also considers the various national competences as well as its role with respect to cooperation and activities underway on a Union level.

The Portuguese government recently committed to an overall investment of 3% of GDP by 2030 in research and development (R&D). The targets proposed by Portugal for 2030 with regard to energy and climate for carbon neutrality by 2050 require continued growth in investment in low-carbon technologies. It is thus clear that investments in R&D in the areas of energy and climate will grow in the national panorama until 2030.

Table 17- National funding targets for research and innovation in the public and private sectors (% of GDP)

	2020	**2030**
Total R&D investment in Portugal	1.8%	3.0%
R&D investment in energy	-	0.2%
R&D investment in water and the climate	-	0.2%

The European strategy for Research, Development and Innovation for the energy sector, including the European Strategic Energy Technology Plan (SET Plan), Horizon Europe (current programme proposal that will succeed Horizon 2020) and the Investment Plan for Europe (Juncker Plan), integrate R&D targets for the energy sector for the 2020-2030 time frame. Portugal's participation and cooperation in the SET Plan has resulted in clear benefits in terms of combining efforts to achieve common objectives for the penetration of new technologies and responding to joint challenges with respect to disruptive actions. Portugal has participated in several implementation groups and activities and considers collaboration in specialist groups for carrying out coordinated action and other forms of collaboration to develop guided projects to be important. The aim is to comply with ambitious targets for the 2030 horizon.

Based on the objectives and targets set out for the remaining aspects in NECP, national programmes are planned to promote RD&I, which initially, will include as a minimum, the following topics: (i) Energy management smart systems and new infrastructures; (ii) Energy Storage; (iii) Low-carbon technologies; (iv) Energy Efficiency; (v) Hydrogen as an energy source.

It is also important to provide programmes for competitiveness in the area of energy with a view to increasing the quality and competitiveness of national RD&I and accelerating the implementation of research results and the replication of such results. Competitiveness programmes will also include, as a minimum, the following topics: (i) Support for participation in high-quality international research and development; (ii) Support for establishing technological pilots; (iii) Support for training, capacity-building and mobility; (iv) Support for creating industrial clusters in new areas of technological development; (v) Support for promoting business models based on low-carbon products and services; (vi) Support for implementing results.

Portugal is also developing a set of 15 Thematic Agendas for Research and Innovation, coordinated by the Foundation for Science and Technology (*Fundação para a Ciência e Tecnologia*, I.P. - FCT), which specifically aim to mobilise experts from R&D institutions and companies to identify challenges and opportunities in the national scientific and technological system.

These agendas are also expected to contribute toward developing research and innovation and respond to the problems and needs of different sectors of society. Agendas will be developed for different areas that have a significant impact on energy transition and climate action, more specifically, the Agri-food sector, Forests and Biodiversity, Climate Change, Urban Science and Cities for the Future, Circular Economy, Industry and Manufacturing, Oceans, Sustainable Energy Systems, among others.

The inclusive and dynamic process of developing the agendas, involving experts drawn from academia, research centres, companies, public entities and citizens, to create a dialogue among different national actors, made it possible to identify promising and emerging areas for Portuguese research and innovation, with a medium and long-term perspective, for the 2030 horizon.

ii. National objectives, including long-term targets, for the deployment of low carbon technologies

Not applicable.

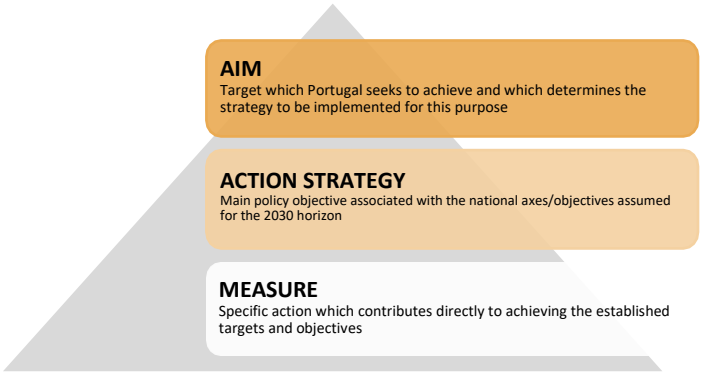
iii. National objectives with regard to competitiveness

Not applicable.

3. POLICIES AND MEASURES PLANNED

The eight targets of NECP, described in Chapter 1, include 58 lines of action and 206 associated measures, described in charts for each line of action. These include a description, identification of the main sectors covered, the action measures that contribute toward each line of action and the respective time frame for implementation. Other information includes the main relationships with other public policy strategic instruments and strategic instruments that frame the respective measures, indicative sources of funding and a pre-identification of the entities responsible for developing and implementing the measures. It is important to note that most measures will continue over time and thus the indicated time frame is the same as that set out in the plan. Each line of action also identifies the contribution toward each of the dimensions of NECP.

The distribution of measures was readjusted to complete this template, while maintaining the original numbering.



3.1. Dimension Decarbonisation

3.1.1. GHG emissions and removals

i. Policies and measures to achieve the target set under Regulation [ESR] as referred in sub-chapter 2.1.1 and policies and measures to comply with Regulation [LULUCF], covering all key sectors

As mentioned in section 1.1.3, one of the strategic targets of NECP is to outline a pathway to reduce national emissions of GHG in order to achieve the target of carbon neutrality by 2050 and to promote the mainstreaming of mitigation aims in sector policies.

The scenarios analysed under RCN2050 confirmed the potential to reduce GHG emissions in all sectors of the national economy. Also identified are the viability and good cost effectiveness of energy efficiency options and penetration of renewable energies, thus contributing to compliance with climate policy objectives. Modelling demonstrated cost-effective trajectories and guidelines for sector policies - action strategies - contributing to objectives for GHG emission reduction, renewable energies and energy efficiency.

To decarbonise the economy and achieve the targets that have been set at a national level to reduce GHG emissions by 2020 (-18% to -23%, as compared to 2005) and by 2030 (-45% to -55%, as compared to 2005), it is necessary to act in all sectors of activity, namely, energy, residential and services sectors, industry, transport and mobility, waste and wastewater, agriculture and forestry and other land uses. It is also necessary to act in a transversal manner to promote green taxation, develop a more circular economy and ensure the sustainability of the territory and cities. Public administration also plays an important role in leading the way toward decarbonisation, while the role of research and innovation is equally essential.

Decarbonising the national economy is a transversal objective, toward which the different targets that have been set out all contribute, namely, the targets concerning energy efficiency, renewables, mobility and transport, agriculture and forestry and industry.

ACTION STRATEGY

1.1 PROMOTING THE DECARBONISATION OF THE ELECTRICITY GENERATION SECTOR

DESCRIPTION

Promote the sector's energy transition, gradually reducing the use of fossil fuels, focusing on endogenous sources of renewable energy, reducing Portugal's energy dependence. Ensure the end of coal-generated electricity in mainland Portugal and promote the phasing out of electricity generation from fuel oil and diesel in the Autonomous Regions.

SECTOR(S)

Energy, Buildings

ACTION MEASURES

To promote the decarbonisation of the electricity generation sector, the following measures are planned, in addition to the action measures set out in Target 3 – REINFORCE RENEWABLE ENERGY AND REDUCE ENERGY DEPENDENCE:

1.1.1. Cease coal-based electricity generation

The gradual reduction in the use of fossil fuels to produce electricity, particularly coal, is essential to guarantee an energy transition and a carbon neutral society. Thus, in 2016 Portugal committed to stop producing electricity from coal by 2030 at the latest, and is a member of the Powering Past Coal Alliance (PPCA), a global alliance of national and sub-national governments, companies and organisations working to promote the transition from coal-generated energy. This transition is opportune and necessary to meet the international commitments established by the Paris Agreement.

With this goal in mind, and considering factors that strongly discourage generating electricity from coal, such as the rise in the price of CO_2 emission licences, the end of ISP exemptions and higher prices for coal, as well as studies to ensure the security of supplies that have been prepared, the thermal power plant in Pego is scheduled to be closed in 2021 and the thermal power plant in Sines will be closed in 2023. The necessary technical assessments will be carried out which take into consideration the evolution of the electricity network and electricity-generating facilities to assess the impact and identify possible mitigation measures for the NES.

To ensure fair transition, this process will be monitored by a multidisciplinary group created for the purpose, with representatives from the energy, environmental, economy, employment and other relevant sectors. It will assess energy issues (e.g. security of supplies), local matters (e.g. local development), social issues (e.g. employment, retraining) and environmental questions. A study will be prepared to ascertain the need for professional retraining for workers. [Expected date: 2019-2023]

1.1.2. Assess the conversion of coal-fired power plants to renewable sources

Alternative solutions may be introduced to mitigate the effects of the closure of these two coal-fired power plants, such as recycling and reusing the equipment of these power plants to produce electricity from renewable sources.

Two possibilities will be studied and assessed to recycle and reuse this equipment: (i) installation of thermoelectric solar capacity with storage to produce renewable steam, to substitute coal, which can directly feed the existing turbines in the power plants; (ii) direct use of green hydrogen as a fuel to substitute coal to feed the power plants. [Expected date: 2020-2021]

1.1.3. Promote the phasing out of electricity generation from fuel oil and diesel in the Autonomous Regions

The autonomous regions have implemented an energy policy aligned with national and international guidelines and commitments in this regard, being equally committed to decarbonising the economy and electricity generation. This is reflected in the promotion of sources of renewable energy with a view to reducing GHG emissions and imports of fossil fuels.

In the case of the electricity sector, decarbonisation requires substituting the thermal power plants that use fuel oil or diesel with renewable energy, complemented by solutions that ensure the security and quality of the supply.

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation

MAIN INSTRUMENTS
RNC2050; RMSA-E; EAE 2030

SOURCES OF FUNDING
Just Transition Fund

ENTITY RESPONSIBLE
The Ministry of the Environment and Climate Change (MAAC); Regional Government of Madeira (GRM); Regional Government of the Azores (GRA)

ACTION STRATEGY
1.2. APPLY EU ETS

DESCRIPTION
Ensure that the ETS system is suitably implemented in Portugal, adapting it to new Community rules, to promote a reduction of GHG in economically efficient conditions that provide a good cost-effectiveness relationship.

SECTOR(S)
Energy; Industry

ACTION MEASURES
The following action measures are planned to implement the ETS system, in addition to its implementation at a national level:

1.2.1. Promote a strategy to exclude installations under the ETS 2021-2025 system
Establish a procedure at a national level for the possible exclusion of facilities emitting less than 25 000 tCO_{2eq} from the ETS system provided that they are subject to measures that enable an equivalent reduction of emissions, and possibly exclude facilities emitting less than 2 500 tCO_{2eq} (without being subject to equivalent measures). [Expected date: 2020]

1.2.2. Establish the legislative framework for a mechanism for indirect cost compensation in ETS
Establish rules concerning state aid for ETS, adopting special and temporary measures in favour of sectors and sub-sectors exposed to a significant risk of fugitive carbon, meeting the costs related with GHG emissions that are reflected in the price of electricity. [Expected date: 2020]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation

MAIN INSTRUMENTS
ETS Directive

SOURCES OF FUNDING
FA

ENTITY RESPONSIBLE
MAAC; GRA; APA

ACTION STRATEGY
1.3. REDUCE THE CARBON INTENSITY OF BUILDING STOCK

DESCRIPTION
Reduce the carbon intensity of buildings, consume energy more efficiently, promote greater electrification in the sector, substitute fossil fuels with renewable energy sources, promote the use of low-carbon materials, promote behavioural changes and increase the shared economy, focus on rehabilitation with a view to increased energy and water efficiency and greater thermal comfort, contributing toward reducing energy poverty.

SECTOR(S)
Hydro

ACTION MEASURES

The following action measures are planned to reduce the carbon intensity of the building stock, in addition to the action measures to improve energy efficiency in buildings as set out in Target 2 – PRIORITISE ENERGY EFFICIENCY and the action measures set out in Target 3 - REINFORCE RENEWABLE ENERGY AND REDUCE ENERGY DEPENDENCY:

1.3.1 Promote rehabilitation as the main form of intervention in building stock and urban development Promote the rehabilitation of buildings as the main form of intervention in the building stock, increasing the useful life of buildings with the consequent return on the environmental resources that have already been invested. This will contribute toward reducing GHG emissions. Minimise construction waste and contribute toward conserving nature and biodiversity. [Expected date: 2020-2030]

1.3.2. Promote sustainable techniques in construction and sustainable buildings

Promote the incorporation of secondary raw materials in construction components, bioclimatic architecture, passive houses and modular, multi-purpose and dynamic architecture. Promote the reuse of construction components and the use of recycled materials, both for new construction as well as rehabilitation. Promote the certification of buildings as a distinctive instrument of sustainable construction (e.g. ecological label, classification systems based on efficiency and sustainability criteria, life-cycle analysis, cradle to cradle approaches – cyclical systems). Improve the energy and water efficiency of buildings and reduce energy needs, including energy incorporated into the construction itself, and promote the use of renewable sources of energy. [Expected date: 2020-2030]

1.3.3. Promote the electrification of buildings accompanied by an increased use of renewables

The electrification of final consumption has been identified as one of the most important factors for decarbonising the economy as it is associated with the growing incorporation of renewable sources for generation. Thus, new buildings must favour adopting renewable sources of energy, promoting the substitution of fossil fuels in buildings. [Expected date: 2020-2030]

CONTRIBUTION TO THE DIMENSIONS OF NECP

Decarbonisation; Energy Efficiency; R&I&C

MAIN INSTRUMENTS

RNC2050; ACTION PLAN FOR THE CIRCULAR ECONOMY (PAEC); NATIONAL STRATEGY FOR THE AIR (ENAR); ENERGY CERTIFICATION SYSTEM FOR BUILDINGS (SCE)

SOURCES OF FUNDING

Financial Instrument for Urban Rehabilitation and Revitalisation (IFRRU) 2020; Efficient House 2020; National Building Rehabilitation Fund (FNRE); The Rehabilitate to Rent Programme

ENTITY RESPONSIBLE

MAAC; Ministry of Infrastructure and Housing (MIH); GRA; GRM

ACTION STRATEGY

1.4. REDUCE THE PRODUCTION OF WASTE AND DIRECT DEPOSIT OF WASTE IN LANDFILLS AND PROMOTE RECYCLING CHAINS

DESCRIPTION

To decarbonise the waste sector, it is essential to reduce the production of waste and, if this is not possible, to reintroduce it into the economy with added value. Pursuant to Community legislation and the national strategy, it is important to encourage enhanced operations in the waste hierarchy, reducing waste sent to landfill and increasing the separated collection of recycling materials to promote recycling chains.

SECTOR(S)

Waste and Wastewater; Circular Economy

ACTION MEASURES

The following action measures are planned to reduce the production of waste and waste being directly sent to landfill and promoting recycling chains:

1.4.1. Prevent the production and danger of wastes

Preventing the production and hazards of wastes will be achieved by means of preventive actions in the industrial, commercial and consumer sectors, promoting voluntary agreements with priority on the promotion of cleaner production and the sustainable design of products and by reducing food waste. [Expected date: 2020-2030]

1.4.2. Increase preparations to reuse and recycle and improve the quality of recyclables

This will be achieved by increasing the quantity and quality of materials that are collected and reused by implementing technical specifications and increasing the quantity and improving the quality of biodegradable urban waste (BUW) by promoting separated collection. [Expected date: 2020-2030]

1.4.3. Reduce waste sent to landfill

Waste sent to landfill will be reduced by diverting recyclables from landfills, diverting BUW from landfills and diverting rejected Urban Waste (UW) from landfills. [Expected date: 2020-2030]

1.4.4. Consolidate and optimise the waste management network

This will be achieved by ensuring easy access and proximity of the collection network for users and selective separation, promoting synergies for the collection and processing of waste on the basis of complementarity. It will be possible to consolidate and optimise the waste management network through more efficient treatment using the best available technology. [Expected date: 2020-2030]

1.4.5. Promote electricity generation in waste management plants

Promote and support the installation of equipment that enables the recovery of landfill gases and biogas from anaerobic digestion facilities to transform them into biomethane, reassessing the process for remunerating electricity generated from UW in these processes. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation

MAIN INSTRUMENTS

RNC2050; STRATEGIC PLAN FOR URBAN WASTE (PERSU) 2020+; PAEC; ENEA; NATIONAL STRATEGY FOR COMBATING FOOD WASTE (ENCDA); STRATEGIC PLAN FOR THE PREVENTION AND MANAGEMENT OF WASTE IN THE AZORES (PEPGRA)

SOURCES OF FUNDING

n.s.

ENTITY RESPONSIBLE

MMAC; GRA

ACTION STRATEGY

1.6. DECARBONISATION OF CITIES

DESCRIPTION

Place cities at the forefront of sustainable mobility, creating conditions for a paradigm shift in urban mobility. Reduce the carbon intensity of the building stock (residential and commercial) and use energy more efficiently. Improve knowledge on how to mitigate climate change, disseminating best practices and promoting low-carbon behaviour in society. The sustainable and rational use of land will also be promoted, minimising GHG emissions and intensifying carbon sequestration; focus on containing urban perimeters, limiting soil sealing.

SECTOR(S)

Territory and Cities; Mobility and Transport

ACTION MEASURES

The following action measures are planned to decarbonise cities, in addition to the action measures envisaged for the lines of action corresponding to Target 5 – PROMOTE SUSTAINABLE MOBILITY and Target 2 – PRIORITISE ENERGY EFFICIENCY:

1.6.1. Reduce the carbon intensity of the urban transport and logistics system

Prepare and implement Mobility and Transport Plans (MTP) or Action Plans for Sustainable Urban Mobility (APSUM) by Inter-Municipal Communities/Metropolitan Areas (CIM/AM) and municipalities with more than 50 000 inhabitants or which are district capitals. Promote demand management (passengers and goods) and urban planning to reduce the volume of trips (traffic) and distances. Create Reduced Emissions Zones (REZ), when applicable. Implement tools to support mobility management and information technology and systems to support mobility and communication – smart mobility – aimed at users (providing real time information at stops, public information websites, apps for mobile devices). [Expected date: 2020-2030]

1.6.2. Promote the development of low-carbon plans and strategies, calculation and reporting of GHG emissions by sectors of activity and low-carbon certification

Develop low-carbon plans and strategies by municipalities and companies, promote calculation and reporting of GHG emissions at a local level and at companies and certificates for low-carbon standards.

These strategies for the short and medium-term must be aligned with the national target of achieving carbon neutrality by 2050.

To this end, existing regional or inter-municipal roadmaps for carbon neutrality should be coordinated [Expected date: 2020-2030]

1.6.3. Promote the participation of organisations in actions to promote, disseminate and demonstrate best practices and networks to share information concerning low-carbon objectives and better air quality

Promote participation in initiatives to disseminate best practices concerning the mitigation of climate change, participation in networks, namely with the purpose of sharing information on low-carbon objectives, disseminating information and raising awareness among the population through local means of communication and the installation of billboards. Promote environmental education programmes in schools to make younger people aware of the issue of climate change and air quality, as well as promote living laboratories to decarbonise cities, which involve the municipality, knowledge institutions and companies to develop pilot projects. [Expected date: 2020-2030]

1.6.4. Contain the expansion of urban areas and limit soil sealing

Prevent the conversion of green spaces and the subsequent sealing of such surfaces. Reinforce the development of existing urban areas and promote the coordination of natural values to be safeguarded. Support operations for rehabilitating and renovating the building stock throughout the planning process, to the detriment of new construction. Ensure that urban design favours pedestrians. Promote greater cooperation among municipalities. Include strict preventive measures in spatial planning instruments and promote effective monitoring. Concentrate all the binding rules for private individuals in Municipal Master Plans. Clarify the Land System, ending urban development land. Make territorial planning more flexible. Make the process of strategic environmental assessments more effective so as to better scrutinise, at a preliminary stage, strategies, plans and programmes concerning increased risk and the impact on climate change, soil degradation and GHG emissions. Create a governance framework operating on a regional scale. [Expected date: 2020-2030]

1.6.5. Regenerate and revitalise urban centres, considering sustainability criteria

Promote the functional densification of urban areas, including diversifying and reinforcing services and local commerce, which promote sustainable mobility. Promote energy sustainability in public spaces and urban systems, including energy efficiency for public lighting and the energy and water efficiency of urban water and sanitation systems. Promote the energy sustainability of industrial, technological and business parks and ports and logistical platforms. Promote urban agriculture, by creating appropriate spaces for the purpose integrated into the urban structure. Promote the expansion, improvement and integration of urban green spaces, promoting their role as carbon sinks and regulators of urban microclimates. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation; Energy Efficiency; R&I&C

MAIN INSTRUMENTS

RNC2050; Sustainable Cities 2020; ENAR; national Spatial Planning Policy Programme (PNPOT); Sustainable Urban Mobility Plan (PMUS); Annual Emissions Monitoring Plan (PMEA); Regional Spatial Planning for the Alentejo (PROTA)

SOURCES OF FUNDING

n.s.

ENTITY RESPONSIBLE

MAAC; Public Prosecutor (MP); MIH; Ministry of Science and Technology (MCT); GRA

ACTION STRATEGY

1.8. PROMOTE THE TRANSITION TO A CIRCULAR ECONOMY

DESCRIPTION

To decarbonise the economy, circularity levels will be increased with regard to the use of materials, leading to the extensive implementation of (new) business models that replace the supply of goods with the provision of services and ownership through use. Proximity between production and consumption will be promoted as will reducing consumption, transforming waste into (new) resources. Implement the vision and actions of a circular economy, which contribute toward reducing GHG emissions, as set out in the Circular Economy Action Plan (PAEC).

SECTOR(S)

Waste and Wastewater; Industry; Services; Residential; Transport

ACTION MEASURES

The following action measures are planned to promote transition to a circular economy:

1.8.1. Promote the recirculation of materials

Promote the market for recyclable materials. Promote classification as a sub-product and end the status of waste, including coordination with laboratories collaborating with a circular economy. Strengthen specific flow management systems for waste, with a view to creating synergies and assessment of the implementation of the Extended Producer Responsibility (EPR) to emerging flows. Promote the establishing of new industrial areas developed from and industrial symbiosis perspective, with plans for the rational use of materials and energy and the rehabilitation of existing industrial areas. Promote regional agendas based on an analysis of the regional situation and identify opportunities to close cycles. Improve the level of the treatment of the solid phase of WWTPs to optimise the process from an environmental, technical and economic point of view and find uses for respective sludge. Develop innovative projects in the area of converting WWTPs into factories to add value to resources with zero CO_2 emissions. Promote the production and use of water for reuse, obtained by treating wastewater. Promote sector agendas for the circular economy. Promote the use of the compost resulting from the processing of bio-waste. Encourage design that allows dismantling and easier separation of materials. Recover energy from materials. Promote the use of biogas to produce energy. Promote the incorporation of waste into biofuels. Promote the use of the energy generation capacity of SA systems, namely by using biogas. [Expected date: 2020-2030]

1.8.2. Promote the material efficiency of products

Improve the manufacturing process to produce less waste. Reuse components in the production process. Encourage the design of products to contain less material and more resistant and durable materials. Stimulate design to incorporate natural or recovered materials. [Expected date: 2020-2030]

1.8.3. Promote circular business models

Encourage innovation in supplying new and radically different products that make it possible to make existing products redundant and thus unnecessary or which offer the same function with a radically different product (e.g. digitalisation). Encourage greater and intensive use of products through sharing and ownership through use. Encourage greater longevity of products by: design for durability and recycling, improved maintenance, reconditioning, re-manufacturing discarded products (or parts/components) into a new product, with the same functions and reallocating the discarded products (or parts/components) into a new product with different functions. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation; Energy Efficiency; R&I&C

MAIN INSTRUMENTS

RNC2050; PAEC; PERSU 2020+; Strategy for Water Supply and waste Water Treatment Sector (PENSAAR) 2020; PEPGRA

SOURCES OF FUNDING

EF

ENTITY RESPONSIBLE

MAAC, METD

ACTION STRATEGY

6.2. PROMOTE DECARBONISATION FOR LIVESTOCK ACTIVITY

DESCRIPTION

The objective is to reduce the carbon intensity of livestock activities, in coordination with lines of action concerning renewable energy sources in the agriculture and forestry sectors of this target.

SECTOR(S)

Agriculture; Energy

ACTION MEASURES

The following action measures are planned to promote the decarbonisation of livestock activity:

6.2.1. Promote the installation or reconversion of effluent treatment and management systems to reduce GHG emissions

Promote the management of livestock effluents as a fundamental factor to reduce GHG emissions in this sector. [Expected date: 2020-2030]

6.2.2. Support improvements in the digestibility of animal feed

Improving the digestibility of animal feed produced in intensive and extensive systems can be an effective way of reducing GHG emissions. [Expected date: 2020-2030]

6.2.3. Promote integrated solutions to treat livestock and agro-industrial effluents

The new national Strategy for Livestock and Agro-industrial Effluents (ENEAPAI 2025) is based on a joint desire of the agriculture and environmental sectors to provide a technical and economically viable solution for the aforesaid sectors, focusing firstly on pig farming in the Leiria and Western Portugal region, given the high concentration of pig farmers in this area.

This means designing a solution that is flexible in time and space that enables an environmentally sustainable means of operation and allows producers to make investment decisions considering new methodologies currently being implemented in this sector, more specifically by shifting production to locations where it is possible to use effluents for agricultural purposes in soils that are deficient in organic matter, as from the point of view of production costs it is better to reuse than to treat waste. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation; Energy efficiency

MAIN INSTRUMENTS

RNC2050; future PEPAC; ENEAPAI 2018-2025; NREAP

SOURCES OF FUNDING

EAFRD; Cohesion Fund

ENTITY RESPONSIBLE

MA; MAAC; GRA

ACTION STRATEGY

6.3. REDUCE THE CONSUMPTION OF NITROGEN FERTILISERS

DESCRIPTION

Encourage a reduction in the use of nitrogen fertilisers using a Code of Agricultural Best Practices (Official Order No 1230/2018 of 5 February 2018), the National Limits Directive (Decree-Law No 84/2018 of 23 October) and the EU Regulation for fertiliser products (which will substitute the current Regulation (EC) 2003/2003 on fertilisers) as a reference, in coordination with the action line relating to bio-economy within this target.

SECTOR(S)

Agriculture; Circular Economy

ACTION MEASURES

The following action measures have been planned to reduce the consumption of nitrogen fertilisers:

6.3.1. Adopt a Code of Agricultural Best Practices

Prepare and adopt a code of best practices to reduce the use of nitrogen fertilisers, as this promotes a reduction in GHG emissions and ammonia. [Expected date: 2020-2030]

6.3.2. Improve the efficiency of fertiliser use in the soil

Promote the implementation of fertiliser techniques that minimise the loss of nutrients by expanding organic and precision agriculture, reducing the emissions associated with animal effluents and the use of fertilisers and promoting increased carbon sequestration due to increased organic matter in soils. [Expected date: 2020-2030]

6.3.3. Substitute the use of mineral fertilisers with organic fertilisers

Encourage the substitution of mineral fertilisers with organic fertilisers, namely compost. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation; R&I&C

MAIN INSTRUMENTS

RNC2050; future PEPAC; ENEAPAI 2018-2025; ENAR; PAEC; New Poultry Farming Regime (NREAP); BREF poultry and porcine

SOURCES OF FUNDING

EAFRD; EAGF

ENTITY RESPONSIBLE

MA; MAAC; GRA

ACTION STRATEGY

6.5. INCREASE THE NATURAL CARBON SINK CAPACITY OF AGRICULTURE AND FORESTRY

DESCRIPTION

To ensure an increase in the carbon sink capacity of agriculture and forests, the target entails increasing the sequestration of agroforestry areas and reducing emissions and/or increasing soil sequestration.

SECTOR(S)

Agriculture; Forestry

ACTION MEASURES

The following action measures are planned to increase the natural sink capacity of agriculture and forests:

6.5.1. Support forestation and improve the environmental value of forests

This will be achieved by means of support for the forestation of non-agricultural lands, forestation in lands that are particularly prone to desertification, support for actions to improve the resilience of forest populations, support for conservation and the recovery of habitats and forest areas with great natural value, support for maintaining and conserving riparian galleries, support for reconverting populations installed in unsuitable ecological conditions, using species that are better adapted, increase support for areas subject to forestry management plans and promote the improvement of the economic value of forest populations, support for sustainable forest management certificates, promoting the implementation of the management models and standards of Regional Forest Planning Programmes (PROF), promote Forest Intervention Zones, Forest Management Units, Forest Management Entities, training for agents in this sector and promote ecosystem services. [Expected date: 2020-2030]

6.5.2. Increase the resilience of the landscape to rural fires and reduce their occurrence

Landscape plans will be implemented to promote the diversity of species and multifunctionality in forests, contributing toward greater income for forest producers and making the territory more resilient to rural fires and pests. [Expected date: 2020-2030]

6.5.3. Conserve, restore and improve agricultural and forest lands and prevent erosion

This will be achieved by means of actions to install, conserve and recover riparian galleries, which preserve the water system and prevent erosion, the implementation of agricultural and forestry techniques that increase carbon levels in the soil, namely by minimum mobilisation, direct sowing and grass between rows of permanent crops. Support will also be provided for installing biodiverse permanent pastures, maintaining permanent crops and other operations to improve fertility and the structure of the soil and the use of crops/species that are suited to soil characteristics. [Expected date: 2020-2030]

6.5.4. Continue to support and develop Ecosystem Services Remuneration in Rural Spaces Programmes

The first phase of the Ecosystem Services Remuneration in Rural Spaces Programme, launched in 2019, sought to provide greater competitiveness for rural territories and to ensure a model for greater environmental sustainability, with lower exposure to risks, particularly fires. The remuneration of ecosystem services aims to promote the biodiversity of territories, reflecting a transformation in the way land is used. This is a shift from a model of short-term profitability to a model were returns require a long-term frame but ensure greater value and promote the resilience of the land.

This type of mechanism will continue to be promoted, as it aims to compensate contributions that are not valued by the market, including contributing toward preventing erosion, carbon sequestration, regulating the water cycle, conservation of biodiversity, reduction in susceptibility to fire and improving the quality of the landscape. [Expected date: 2020-2030]

CONTRIBUTION TO THE DIMENSIONS OF NECP

Decarbonisation; R&I&C

MAIN INSTRUMENTS

RNC2050; National Forestry Strategy (ENF); future PEPAC

SOURCES OF FUNDING

PFF; EAFRD; EAGF; Cohesion Fund; EF

ENTITY RESPONSIBLE

Ministry of Agriculture (MA); MAAC; GRA

ACTION STRATEGY

6.6.

DESCRIPTION
Reduce the number of fires, burnt areas and emissions caused by fires and reduce the affected areas and emissions caused by biotic agents.

SECTOR(S)
Agriculture, Forests and other land use

ACTION MEASURES
The following action measures have been planned to promote effective management of the agroforestry system to reduce burned areas and the impact of biotic agents:

6.6.1. Reduce risks (biotic and abiotic) and strengthen the component of the management of rural fires
This will be achieved by implementing a primary network of fuel management strips, fuel management mosaics and a secondary network of fuel management strips. Support the operation of teams of forest firefighters, increase their efficiency and provide the Institute for Nature Conservation and Forests ICNF with a force of forest firefighters. Implement the National Plan for Controlled Fires and the National Programme to Reduce Rural Fire Eruption. Implement the Healthy Forestry Operational Programme and the action plans, contingency plans and plans to control noxious biotic agents. Implement the Action Plan to Control Invasive Woody Species. Reinforce checks on imports and the circulation of woody material and forestry propagation materials. Support capacity building in the sector to promote greater effectiveness of monitoring and controls and reinforce early detection capacity for invasive biotic agents. [Expected date: 2020-2030]

6.6.2. Promote the productivity and improve the economic value of forest populations
This will be achieved by means of an active and professional management of populations, maximising the use of the potential of seasons, using improved plants, multifunctionality, more stringent technical solutions and consolidating or reconverting existing forests, within the framework of a new specialisation in land use, as well as recovering degraded or underutilised forest systems. Production chains should invest in forest-based products with greater added value and ensure fair prices for producers, creating a value chain that has an impact from production to the marketing of the final product. [Expected date: 2020-2030]

CONTRIBUTION TO THE DIMENSIONS OF NECP
Decarbonisation

MAIN INSTRUMENTS
RNC2050; ENF; Future PEPAC; PNPOT; National Plan for the Integrated Management of Rural Fires (PNGIFR)

SOURCES OF FUNDING
PFF; EAFRD; Cohesion Fund; ERDF; EF

ENTITY RESPONSIBLE
MA; MAAC; GRA

ACTION STRATEGY
6.7. ENCOURAGE THE ROLE OF THE BIO-ECONOMY FOR DECARBONISATION

DESCRIPTION
Promote the decarbonisation of value chains in an economy with a biological base by increasing the use of sub-products/ waste materials derived from agriculture and forestry, with new areas of circular businesses that contribute to reducing GHG emissions.

SECTOR(S)
Agriculture; Forestry; Energy

ACTION MEASURES
The following action measures are planned to encourage the role the bio-economy plays in decarbonisation, in addition to coordination with the action lines for the transition to a circular economy of Target 1, the use of biomass for Target 3 and alternative fuels for Target 5:

6.7.1. Promote the use of residual biomass derived from forestry and agricultural sources
Promote materials, markets and improve management systems for such waste (use composts derived from biowaste, use waste from forest clearing, cutting and thinning, pruning and agricultural harvests for energy purposes), promote new business areas. [Expected date: 2020-2030]

6.7.2. Support the establishment of crop areas for energy purposes using short rotation forestry species
Energy crops can complement biomass derived from forestry or agriculture. Some crops can also be used to produce second generation biofuels. [Expected date: 2020-2030]

6.7.3. Promote the use of agricultural and forestry products to substitute fossil-based raw materials

This will be achieved by using agricultural and forestry products as part of a circular economy and sustainable construction, by providing support for the creation and modernisation of primary processing units for agricultural and forestry products and support for installing waste collection centres and transporting residual biomass. [Expected date: 2020-2030]

CONTRIBUTION TO THE DIMENSIONS OF NECP

Decarbonisation

MAIN INSTRUMENTS

RNC2050; ENF; PAEC; future PEPAC; National Programme for the Production and Use of Biodiesel (PNPB)

SOURCES OF FUNDING

EAFRD; Cohesion Fund; ERDF

ENTITY RESPONSIBLE

MA; MAAC; GRA[24]

ACTION STRATEGY

7.1. PROMOTE THE DECARBONISATION OF INDUSTRY

DESCRIPTION

The decarbonisation of industry is planned as part of the strategic objective to promote innovative and competitive industry, promoting the use of renewable resources, energy storage, electrification and use of renewable gases. With an electricity production system that has a strong renewable base, the aim is to promote and reinforce the use of electricity in the different sectors of activity and the economy. In parallel, there will be reinforced use of other renewable energy sources, such as biomass and renewable gases. Industry will play an extremely important role as it is one of the key areas where innovation and the creation of new business models is required. Reinforcement of the circular economy, 'industry 4.0' and technological innovation will be critical on the road to identifying and creating innovative and efficient solutions with close to zero emissions, in the coming 30 years.

SECTOR(S)

Industry; Energy; Waste

ACTION MEASURES

The following action measures are planned to promote the decarbonisation of industry:

7.1.1. Promote renewable sources of energy

Promote and encourage the penetration of renewable sources of energy, particularly solar thermal energy and solar photovoltaic energy as a way of also promoting increased competitiveness by reducing energy costs. [Expected date: 2020-2030]

7.1.2. Increase the use of clean alternative fuels and other national resources that have the potential to be used as a source of energy

Promote and encourage the use and penetration of renewable sources of energy, particularly biomass, renewable gases, waste-derived fuels (WDF) and other clean fuels. [Expected date: 2020-2030]

7.1.3. Promote the electrification of industry

The electrification of consumption is a crucial process to ensure decarbonisation as it makes it possible to substantially reduce energy bills and GHG emissions, as fossil fuels are substituted by cleaner endogenous sources. It simultaneously promotes greater competitiveness for industry. [Expected date: 2020-2030]

CONTRIBUTION TO THE DIMENSIONS OF NECP

Decarbonisation; Energy efficiency

MAIN INSTRUMENTS

RNC2050; ENAR; PERSU 2020+; Regional Plan for Energy Efficiency (PRAEE)

SOURCES OF FUNDING

Community Funds (Operational Programme for Sustainability and Efficiency in the Use of Resources (PO SEUR), Regional OPs)

ENTITY RESPONSIBLE

MAAC; METD; GRA

[24] The measure 'Support the establishment of crop areas for energy purposes using short duration forestry species' is not applicable

ACTION STRATEGY

7.3. PROMOTE ECO-INNOVATION AND CLEANER MANUFACTURING PROCESSES, PROMOTE DIGITALISATION OF INDUSTRY (INDUSTRY 4.0)

DESCRIPTION

The paradigm shift needed in industry for energy transition and carbon neutrality will follow a more incremental path as compared to other sectors. Eco-innovation, digitalisation and more sustainable business models are tools to promote decarbonisation while ensuring differentiation in terms of competitiveness. They can result in significant economic and environmental benefits.

SECTOR(S)

Industry; Energy

ACTION MEASURES

The following action measures are planned to promote eco-innovation and cleaner manufacturing processes and to promote industrial digitalisation (Industry 4.0):

7.3.1. Promote a digital industry (Industry 4.0)

Promote the digitalisation of the industrial sector, incorporating efficient resource-management processes and decarbonising processes, products and services. [Expected date: 2020-2030]

7.3.2. Decarbonise industrial processes

Promote the decarbonisation of industrial processes by introducing low-carbon technologies and processes. [Expected date: 2020-2030]

7.3.3. Minimise the consumption of fluorinated gases and substitute them with natural coolants

Ban the sale of equipment with fluorinated gases with a high PGW (Potential for Global Warming). Prevent the release of fluorinated gases into the atmosphere. Promote the use of natural coolants to substitute fluorinated gases. [Expected date: 2020-2030]

CONTRIBUTION TO THE DIMENSIONS OF NECP

Decarbonisation; Energy efficiency

MAIN INSTRUMENTS

RNC2050; INDUSTRY 4.0

SOURCES OF FUNDING

Innovation, Technology and Circular Economy Fund (FITEC)

ENTITY RESPONSIBLE

METD; MAAC; GRA

ACTION STRATEGY

7.4. PROMOTE THE CIRCULAR ECONOMY IN INDUSTRY

DESCRIPTION

By promoting a circular economy in the industrial sector, it is possible to encourage innovation, develop new products and business models, reduce the consumption of energy and materials and help fight climate change.

SECTOR(S)

Industry; Services; Waste

ACTION MEASURES

To promote the circular economy in industry, the following action measures are planned:

7.4.1. Promote a circular and low-carbon economy in the industrial sector

Promote the circular economy, the efficient use of resources and prevent the production of waste, namely by using waste as raw material, industrial symbioses, extending the use of goods and equipment, the penetration of product-service models and designing products with a low-carbon profile. [Expected date: 2020- 2030]

7.4.2. Promote industrial symbioses (urban, local, regional);

Use sub-products and waste to substitute primary raw materials. [Expected date: 2020-2030]

7.4.3. Promote the development of low-carbon products and services projected for different life cycles

By adopting tools to assess the sustainability of products and services and to identify applicable solutions, such as assessing the life cycle, certifications for products and services (e.g. ecological labels, EMAS) among others. [Expected date: 2020-2030]

CONTRIBUTION TO THE DIMENSIONS OF NECP
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
RNC2050; PAEC

SOURCES OF FUNDING
FITEC; EF

ENTITY RESPONSIBLE
MAAC; METD; GRA

ACTION STRATEGY

8.3. IMPROVE KNOWLEDGE WITH REGARD TO MITIGATING CLIMATE CHANGE, DISSEMINATE BEST PRACTICES AND PROMOTE LOW CARBON BEHAVIOURS IN SOCIETY

DESCRIPTION
Promoting greater participation by citizens and civil society is vital to the success of climate and energy policies. It is necessary to send a message of greater proximity and connection with people and essential to highlight the role that each individual can play in adopting solutions, in terms of changing behaviour and by making more sustainable consumption decisions. Capacity-building in society and creating competences that are associated with the creation of green jobs. Orient individual behaviours toward efficient resource-management and low-carbon decisions and promote the active involvement of society in this transition. Support the dissemination of best practices and participation in networks to exchange experiences.

SECTOR(S)
All; Civil Society

ACTION MEASURES
The following measures are planned to promote knowledge of the mitigation of climate change, to disseminate best practices and to promote low-carbon behaviour in society, in addition to the action measures concerning the development of low-carbon plans and strategies and disseminating best practices and information on climate change at a local level pursuant to Target 1 – DECARBONISE THE NATIONAL ECONOMY:

8.3.1. Promote capacity-building (education and training) to mitigate climate change, develop a low-carbon economy and improve air quality
Implement the low-carbon and air-quality aspects of the National Environmental Education Strategy. Develop educational initiatives on the mitigation of climate change and on air quality as part of existing curricula. Support the development of training actions that make it possible to create competences to support the transition to a carbon neutral economy and better air quality. [Expected date: 2020-2030]

8.3.2. Improve knowledge on a low-carbon economy and mitigating climate change
Develop studies and projects that contribute toward in-depth knowledge, improve access to information, develop tools to support designing policies to mitigate climate change and promote a low-carbon economy. [Expected date: 2020-2030]

8.3.3. Promote awareness actions for low-carbon behaviour
Diverse actions in keeping with the measures identified at a sector level with regard to the 'behaviour' vector. Develop awareness campaigns to promote a low-carbon economy. [Expected date: 2020-2030]

8.3.4. Promote awareness and capacity-building (education and training) actions for more sustainable production and consumption patterns
Ensure that citizens have access to relevant information and suitable awareness to adopt behaviour resulting in more sustainable production and consumption patterns. For this purpose, awareness campaigns for sustainable production and consumption will be carried out, with the participation of various parties involved in value chains (manufacturer-distributor-consumer), with particular emphasis on sectors that have a special multiplier effect, such as the distribution sector and tourism sector, that directly influence consumers and supply chains. Capacity-building will also be promoted, at the level of compulsory education, by inserting educational content/projects in this area. Promote training for entrepreneurs and consumers, in liaison with interested parties and NGOs, as well as in coordination with the distribution sector. Promote suitable training for employees in direct contact with consumers. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy Efficiency; R&I&C

MAIN INSTRUMENTS
RNC2050; ENEA

SOURCES OF FUNDING
EF; Community Funds (PO SEUR, Regional OPs)

ENTITY RESPONSIBLE
MAAC; GRA; DGEG; APA; (Energy Agency) ADENE

ACTION STRATEGY

8.5. PROMOTE PLATFORMS FOR A DIALOGUE ON SUSTAINABLE DEVELOPMENT AND LEVERAGE INTERVENTION CAPACITY AT A NATIONAL, REGIONAL AND LOCAL LEVEL

DESCRIPTION
Promote permanent and enduring platforms for dialogue and debate on a national and local scale, which involve the main agents from various sectors and can actively contribute toward building a more transparent, proactive and inclusive energy policy, ensuring compliance with Portugal's energy and climate goals and commitments.

SECTOR(S)
Transversal

ACTION MEASURES
The following action measures are planned to promote platforms for dialogue on sustainable development and to leverage intervention capacity at a national, regional and local level:

8.5.1. Promote the creation of the Portuguese National Energy Council

As is the case with other such existing bodies, the National Council will be an independent consultation body operating at a national, regional and local level. Its mission will be to promote the participation of various social, cultural and economic forces to reach a consensus on energy policy in the context of energy transition. The activities of this advisory body will include: (i) enabling debate among various social, cultural and economic forces to reach a consensus on energy policy; ii) issuing opinions and recommendations when requested to do so by the member of the Government responsible for the energy sector; iii) monitoring national, Community and international energy policy; iv) monitoring the implementation and regulation of legislation in the energy sector; v) issuing opinions on national plans and strategies in the energy sector.

This is intended to be a permanent and enduring platform for dialogue/debate with a constructive spirit for the energy sector. It will involve the main agents from various sectors (public and private) that contribute toward energy transition and civil society, helping develop an energy policy that ensures compliance with Portugal's energy and climate goals and commitments. [Expected date: 2019-2021]

8.5.2. Leverage the role of Local Energy and Climate Agencies

As Local Energy and Climate Agencies are close to local agents and citizens, they are essential entities for promoting sustainable development in the area(s) where they are located, being key players at a local level to achieve national targets, using a local-centric logic. They play a very important role in terms of local sustainable development by promoting energy efficiency, the rational use of energy in various sectors, the use of local endogenous energy resources, the use of new technologies and information and awareness actions, contributing toward the sustainable development of the region and the nation. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
n.a.

SOURCES OF FUNDING
n.s.

ENTITY RESPONSIBLE
MAAC; GRM; GRA

ii. Regional cooperation measures in this area

Not applicable.

iii. Financing measures in this area at national level

See 5.3(iii).

3.1.2. Renewable energy

Portugal aims to transition from fossil fuels to new forms of energy production and consumption, moving toward a carbon neutral future. This path includes continuing to use and maximise Portugal's existing endogenous renewable potential, part of which has yet to be explored, as in the case of solar energy, while simultaneously adopting more stringent consumption patterns and focusing on new and emerging clean technologies.

i. Policies and measures to achieve the national contribution to the binding EU-level 2030 target for renewable energy sources

ACTION STRATEGY
3.1. ACCELERATE THE PRODUCTION OF ENERGY FROM RENEWABLE ENERGY SOURCES, WITH GREATER FOCUS ON RENEWABLE ENERGY SOURCES

DESCRIPTION
The contribution of endogenous renewable sources of energy to generate electricity has been developed significantly over the course of recent years, contributing toward reducing GHG emissions and Portugal's energy dependence. These sources have generated wealth, employment and economic development. However, Portugal has vast potential to produce clean energy from renewable resources, which have mostly yet to be explored, particularly in relation to solar power. It is thus important to reinforce and review current mechanisms to promote renewables so as to ensure compliance with the goals for 2030. Achieving 80% of renewable sources of energy in the electricity sector requires doubling the installed renewable capacity in the 2021-2030 horizon.

SECTOR(S)
Energy; Industry

ACTION MEASURES
To accelerate the production of energy from renewable energy sources, the following action measures are planned:

3.1.1 Promote the development of new renewable capacity, namely by implementing a system of auctions to allocate injection capacity in the electricity network
In a scenario of a high demand for production licences and a shortage of network reception capacity, auctions are the best way of responding to this demand and accelerating investments in new capacity, giving priority to projects with lower costs and greater guarantees for execution. This enables a better coordination of the process of issuing licences and investments in new network capacity. This logic of implementing a system of auctions offers a set of advantages, namely: (i) limiting the risk of investors (ii) economic efficiency, (iii) achieving energy policy objectives.

Auctions will be designed considering the market context and will seek to meet the market's needs, without undermining compliance with the goals set out in NECP and without an onerous burden on consumers. The frequency, number of auctions to be held each year, the format and the technology or technologies that are the subject of each auction will be defined annually, considering the objectives of the evolution of the installed capacity to comply with the goals set out in NECP and the evolution of transmission and distribution networks.

The auction(s) will be announced with sufficient notice to ensure greater predictability for potential bidders.

In addition to attributing a reserve through auctions, new licences to generate electricity from renewable sources will also be issued in the following ways: (i) if there is network capacity, by issuing reservations of network injection capacity, issued by the operator of the public service electricity network (PSEN); or (ii) by means of an agreement between the applicant and the PSEN whereby the applicant assumes the financial burden of building or reinforcing the network as necessary to receive the energy produced by the electricity generator. [Expected date: 2019-2030]

3.1.2. Promote the dissemination of hybrid systems based on renewable technologies and ensure their regulation

The implementation of such systems provides greater flexibility and better use of resources since it allows complementarity between forms of energy and, consequently, the possibility of minimising production costs. Moreover, it makes it possible to maximise network connection capacity by reinforcing capacity without additional investments in the network. A suitable legal framework will be created to develop and implement this type of solution, along with technical criteria applicable for such systems, which will provide the necessary impetus to implement these solutions. [Expected date: 2019-2020]

3.1.3. Promote increased wind power generation, namely through new equipment and repowering

Portugal also has great potential in relation to wind energy. It is important to provide the necessary conditions for existing wind farms to become more competitive.

New equipment is a rational path that should not continue to be wasted. The new capacity will be installed in existing power plants, where the essence of the environmental impact has already been identified and where it is possible to use surplus network capacity.

In terms of repowering, just like new equipment, the sites of power plants with environmental impact have already been identified. It will also play an important role, since it makes it possible to provide current wind farms with more efficient equipment as they reach the end of their useful life. It is necessary to create favourable conditions and a regulatory framework to implement this solution. [Expected date: 2019- 2021]

3.1.4. Promote renewable cogeneration and gradually reduce incentives for fossil fuel cogeneration

Cogeneration plays a very important role in energy efficiency and reducing GHG emissions, as it is one of the most efficient solutions for generating energy (electricity, heating and cooling).
Moreover, the fact that cogeneration facilities are close to energy consumption points is also reflected in lower losses and a lesser need to invest in infrastructure. It is thus important to promote the implementation of the cogeneration system based on renewable sources of energy as well as to convert existing plants from fossil fuels to renewable sources of energy, making use of endogenous resources. [Expected date: 2020-2025]

3.1.5. Promote oceanic renewable energies

Oceanic renewable energy has the potential to ensure the development of competitive industries in Portugal, which export high value added products and services to an increasingly global market, thus promoting the development of a value chain. Portugal has significant potential for oceanic renewable energies that are worth exploring and also has the potential to create a new export chain for these new energy technologies. [Expected date: 2020-2030]

3.1.6. Promote the production of electricity from geothermal sources

The Autonomous Region of the Azores has vast geothermal resources with high enthalpy used to generate electricity. It will continue to develop this resource to achieve the maximum productivity possible with available resources. [Expected date: 2020-2030]

3.1.7. Promote pilot projects for renewable energy sources that are in the testing stage and are not widespread

Among the projects to be promoted the adjustable pilot power plants to produce solar thermoelectric energy, with storage facilities, are especially worthy of note. [Expected date: 2020-2030]

3.1.8. Implement a guarantee of origin system

It is essential for consumers to know the source of the electricity they consume, especially when it is produced from renewable sources. The implementation of a guarantee of origin system aims to show end users, by issuing electronic certificates, the share or quantity of energy from renewable sources in the energy mix of any given supplier. [Expected date: 2019-2021]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation; Energy Security; Internal Market; R&I&C

MAIN INSTRUMENTS

RNC2050; Azores Energy Strategy (EAE) 2030

SOURCES OF FUNDING

Community Funds (PO SEUR, Regional OPs); Innovation Support Fund (FAI); EF; NER 300 and Innovation Fund (NER 450); Horizonte Europa; Structural
Funds; InnovFin Energy Demo Projects

ENTITY RESPONSIBLE

MAAC; GRA; GRM; DGEG; APA

ACTION STRATEGY

3.2. PROMOTE THE DISSEMINATION OF DISTRIBUTED PRODUCTION AND SELF-GENERATION OF ENERGY AND ENERGY COMMUNITIES

DESCRIPTION

Promote the dissemination of distributed production, i.e. production at the same site as consumption or very close to it. This reduces costs related to transmission and distribution networks, reduces losses and optimises production of electricity solutions.

SECTOR(S)

Energy; Residential; Industry; Services; Agriculture

ACTION MEASURES

The following action measures are planned to promote greater dissemination of distributed production and energy self-generation and energy communities:

3.2.1. Promote distributed production and self-generation of energy from renewable sources, removing obstacles for their dissemination

There is a need to provide incentives for the distributed production of energy, particularly in relation to local production of electricity using solar energy. This will play a fundamental role in reinforcing consumers as active agents and promoting energy communities. It will have an impact on the need to reinforce networks and the centralised production of energy while simultaneously promoting the emergence of new markets and technological solutions. [Expected date: 2019-2030]

3.2.2. Promote the creation and development of energy communities

Energy communities will play a fundamental role in promoting social innovation, capacity-building among citizens in relation to the energy sector and its problems and local social and economic development. They will also simultaneously contribute significantly toward mitigating the problem of energy poverty.

After Decree-Law No 162/2019 of 25 October 2019 was published, which set out the legal framework for renewable energy communities, partially transposing Directive 2018/2001, to implement this legal framework energy communities must be promoted along with a programme to disseminate information and support the creation of such communities. This seeks to reduce information asymmetries and support municipalities and citizens while developing energy communities. [Expected date: 2020-2030]

3.2.3. Promote programmes to support the establishment of energy communities in partnership with municipalities

This measure aims to provide support both technically as well as with regard to obtaining funding, to establish projects for energy communities at a municipal level. This support will be provided through public entities qualified for the purpose in partnership with local partners. Energy communities are expected to be established in the short-term, with special emphasis on municipalities in interior regions and those that have a greater proportion of consumers living in energy poverty. [Expected date: 2020-2025]

3.2.4. Reinforce the Electronic Production Units Registration System (*Sistema Eletrónico de Registo de Unidades de Produção* - SERUP)

The existence of an electronic system that is capable of securely and efficiently regulating and monitoring records for small distributed production units is vital to ensuring that this type of energy production evolves as intended. To this end, it is essential to reinforce the current Electronic Production Units Registration System. [Expected date: 2019-2020]

3.2.5. Implement an electronic information portal on distributed production, self-generation and energy communities
The aim of this portal is to inform consumers and facilitate the entire process of installing distributed production systems, with an emphasis on self-generation. [Expected date: 2020-2022]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy Security; Internal Market; R&I&C

MAIN INSTRUMENTS
RNC2050; Action Plan for Sustainable Energy and the Climate-Madeira (PAESC-RAM)

SOURCES OF FUNDING
EEF; FAI; Community Funds

ENTITY RESPONSIBLE
MAAC; GRM; GRA; DGEG; ERSE; Madeira Electricity Company (EEM) ADENE

ACTION STRATEGY
3.3. PROMOTE THE EFFICIENT USE OF RENEWABLE ENERGIES IN HEATING AND COOLING SYSTEMS

DESCRIPTION
The consumption of energy for heating and cooling environments represents a significant share of energy bills. Moreover, there is great potential for energy efficiency gains for equipment by optimising and substituting equipment, using technologies that consume renewable sources of energy.

SECTOR(S)
Residential; Industry; Services

ACTION MEASURES
The following action measure is planned to promote the efficient use of renewable energies for heating and cooling systems:

3.3.1 Promote the acquisition and renovation of heating and cooling systems that use renewable sources of energy
Encourage and stimulate the substitution and use of heating and cooling systems that use renewable sources of energy, particularly solar thermal energy, boilers adapted to renewable gases, biomass boilers and heat recovery systems and solar photovoltaic energy associated with heat pumps, as well as hybrid systems that combine two or more technologies, to heat spaces in the domestic, services and industrial sectors and in public services. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
RNC2050; PROENERGIA

SOURCES OF FUNDING
FAI; EEF; EF

ENTITY RESPONSIBLE
MATE; DGEG

ACTION STRATEGY
3.4. OPTIMISE AND SIMPLIFY THE LICENSING PROCESS FOR RENEWABLE ENERGY POWER PLANTS

DESCRIPTION
To promote greater use of sources of renewable energy it is necessary to implement changes with respect to licensing, to optimise the process and to introduce simplified and electronic procedures.

SECTOR(S)
Hydro

ACTION MEASURES
The following action measures are planned to optimise and simplify the licensing process associated with renewable energy power plants:

3.4.1. Revise and optimise the current legal framework governing the organisation and functioning of the national electricity system
Among other relevant aspects, revising the current legal framework governing the organisation and functioning of the national electricity system aims to introduce improvements and simplify the system for issuing licences to produce energy and promote competitive procedures as a means of managing the shortage of reception capacity in the PSEN. This will ensure that allocating network injection capacity will benefit consumers.

Considering the complexity of the current legislative framework for this sector, it is equally important to carry out a general revision to simplify and clarify this framework and to reduce the number of laws, contributing toward greater clarity and efficiency while implementing new projects. [Expected date: 2019 – 2021]

3.4.2. Implement a One-Stop-Shop for licensing
Implementing a one-stop-shop will make it possible to streamline licensing procedures for energy production projects, reduce licensing time frames and provide straightforward information to promoters and citizens. The central figure for implementing this action is the 'project manager' who, among other functions, will: (i) identify, manage and solve main problems; (ii) pro-actively manage the licensing process; (iii) disseminate information on the process to interested parties; (iv) identify, manage and mitigate the risks associated with the process; (v) ensure interoperability with other existing licensing platforms (e.g. One-Stop-Shop Environmental Licensing).

An electronic platform will be created to support the one-stop-shop for licensing, which will facilitate licensing procedures and the respective information. This platform will bring together and provide simple and practical information on the licensing process for projects to generate electricity, including information on the evolution of the process. This will promote closer interaction between market agents and the institutions involved in the licensing process, contributing toward reducing costs. [Expected date: 2020-2021]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy Security; Internal Market

MAIN INSTRUMENTS
n.a.

SOURCES OF FUNDING
Community Funds (PO SEUR, Regional OPs)

ENTITY RESPONSIBLE
MAAC; GRA; DGEG

ACTION STRATEGY
3.5. PROMOTE SUITABLE PLANNING FOR TRANSMISSION AND DISTRIBUTION NETWORKS TO REINFORCE THE INTEGRATION OF NEW RENEWABLE CAPACITY

DESCRIPTION
To achieve the targets set for 2030, particularly in relation to renewables, the planning of electricity transmission and distribution networks must ensure the existence of network capacity to receive and deliver electricity, with suitable levels of security and service quality, allowing adequate and efficient development in the domestic electricity market.

SECTOR(S)
Hydro

ACTION MEASURES
The following action measures are planned to promote suitable planning for transmission and distribution networks to reinforce the integration of new renewable capacity:

3.5.1. Adapt the planning criteria for transmission and distribution networks
Suitable planning of transmission and distribution networks is crucial for the success of policies aimed at promoting the use of renewables in the electricity generation system. This is the only way to ensure effective channelling of electricity produced in plants to end users, ensuring the security of supplies and a continuous and high-quality service. It also ensures that only necessary investments are made that meet the needs of the network's evolution.

The new criteria to be adopted, or revised, must consider the new challenges facing electricity transmission and distribution networks during energy transition, particularly with regard to distributed production and self-generation, network intelligence, management support systems, smart meters, storage, energy management, energy communities and electric vehicles, among other relevant aspects. [Expected date: 2020-2025]

3.5.2. Redefine the capacity to receive new production

To enable increased reception of new renewable production without the need to upgrade networks, it will be necessary to assess and revise the criteria by which network reception capacity is defined at each network point. This new definition must consider criteria that make it possible to optimise network capacity, simultaneously ensuring network security and reliability. [Expected date: 2020-2025]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation; Energy Security; Internal Market

MAIN INSTRUMENTS

Development and Investment Plan for the Electricity Transmission Network (PDIRT-E); Development and Investment Plan for the Electricity Distribution Network (PDIRD-E)

SOURCES OF FUNDING

n.s.

ENTITY RESPONSIBLE

MAAC; GRA; ERSE

ACTION STRATEGY

3.6. PROMOTE THE PRODUCTION AND CONSUMPTION OF RENEWABLE GASES

DESCRIPTION

The potential of renewable gases as an efficient fuel to produce heating/cooling and electricity or for transport is recognised as being one of the viable alternatives in the transition to a low-carbon economy, promoting the substitution of fossil fuels and reducing Portugal's energy dependence.

SECTOR(S)

Energy; Industry; Transport; Waste; Agriculture

ACTION MEASURES

To promote the production and consumption of renewable gases, the following action measures are planned:

3.6.1. Regulate the injection of renewable gases

Publish the technical and economic regulations pursuant to Decree-Law No 231/2012 of 26 October 2012, on defining the technical, quality and security requirements for biogas, the gas obtained from biomass and other types of gas, as well as the applicable licensing procedures for facilities that process such gases in a raw state and their injection into the national natural gas system (NNGS). This will be necessary to promote the introduction of renewable gases, particularly hydrogen, biomethane and biogas, for natural gas transport and distribution networks as well as for vehicular use, eliminating current barriers. [Expected date: 2020]

3.6.2. Study and define goals to incorporate renewable gases

Create the necessary conditions and mechanisms that make it possible to recognise, use and promote demand for renewable gases, namely hydrogen and biomethane, with a view to creating a real market for renewable gases in Portugal. To this end, goals will be studied, assessed and defined to incorporate renewable gases into natural gas networks and into various sectors of the economy where such incorporation adds value and enables the decarbonisation of consumption. [Expected date: 2020-2021]

3.6.3. Define and implement a quality certification system for renewable gases

An assessment and certification system will be defined to ensure that renewable gases comply with the minimum quality requirements and do not endanger the security of energy supplies and the continuity and quality of services. [Expected date: 2020-2025]

3.6.4. Implement a guarantee of origin system for renewable gases

It is essential for consumers to know the origin of the renewable gases they consume, especially when they are derived from renewable sources. The implementation of a guarantee of origin system aims to show end users, by means of electronic certification, the share or quantity of energy from renewable sources in the energy mix of a supplier. [Expected date: 2020-2022]

3.6.5. Promote the production and consumption of green hydrogen

Hydrogen has great potential as an energy source, which can function as a store of energy or as a fuel for diverse sectors of the economy.

The development and implementation of technologies to produce hydrogen from renewable sources of energy will be promoted, with a view to disseminating and using endogenous sources, as well as diversifying energy sources and reducing energy dependence.

An industrial policy will be developed to implement a cluster for the production of renewable gases in Portugal, particularly green hydrogen, with a view to positioning Portugal as an important European player in the green hydrogen market, leveraging solar energy as a factor for competitiveness during this phase. Developing an industry to produce green hydrogen in Portugal will make it possible to decarbonise various sectors in the country. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation; Energy Security; I&R&C

MAIN INSTRUMENTS

RNC2050

SOURCES OF FUNDING

EF; FAI; Community Funds (PO SEUR, Regional OPs); Horizon Europe; Innovation Fund; Structural Funds; InnovFin Energy Demo Projects

ENTITY RESPONSIBLE

MAAC; METD; DGEG; National Laboratory of Energy and Geology (LNEG); APA

ACTION STRATEGY

3.7. FOSTER THE IMPROVED USE OF BIOMASS FOR ENERGY PURPOSES

DESCRIPTION

Considering the importance of the forestry sector and the associated value chain for the national economy, as well as the problem and economic and social dimension of rural fires it is essential to implement energy use solutions that make it possible to manage rural spaces by removing combustible content, along with developing and improving forestry planning and management systems. This is feasible using a solution or set of solutions that make it possible to justify and generate a return from such interventions, creating a veritable business model that is locally implanted and managed, associated with the creation of a national market for biomass or, at least, self-sustaining regional markets.

SECTOR(S)

Energy; Forestry; Agriculture

ACTION MEASURES

To foster the improved use of biomass for energy purposes, the following action measures are planned:

3.7.1. Promote biomass-based energy generation on a local scale

Promote and support the installation of smaller-sized, decentralised thermal power plants, which do not place great pressure in terms of the availability of biomass and the energy system, promoting the substitution of fossil fuels and decarbonising consumption in various sectors. This solution can be combined with other solutions with variable dimensions and using other kinds of combustible raw materials, but always with the triple objective of contributing toward reducing the combustible material in forestry spaces, using energy efficient solutions and minimising the burden on the National Electricity System.

This action will be developed on the basis of the results of a study on establishing a network of small power plants to make use of biomass. This study will be developed over a set of phases, which will involve various actors from the local and central state administration, research centres and private parties interested in contributing towards solving this problem. The final objective is to develop and launch concrete projects, with a minimum of four concept projects. This process will involve: (i) surveying information, sources and data to quantify the forestry biomass resource; (ii) identifying and studying methodologies to quantify the biomass resource;

(iii) mapping the availability of various types of biomass; (iv) identifying areas where available resources and thermal needs overlap; (v) technological solutions to use biomass; (vi) benchmarking and assessing successful cases; (vii) funding systems/incentives to support related studies and investments. [Expected date: 2019-2020]

3.7.2. Promote and support the dissemination of centres to collect and store biomass and make it available at a municipal or inter-municipal level

Centres to collect and store biomass, at a local level with good geographic distribution, ensure a suitable management of the forest and other biomass wastes, making it possible to optimise the biomass collection and reception processes, providing resources that can be used and thus add value, with a local energy dimension. [Expected date: 2020- 2030]

3.7.3. Promote actions for information and awareness

The actions to be developed include the creation of a pedagogical dossier for professional training to improve and optimise the collection and transformation of residual forestry biomass, the production of a manual of best practices to use forestry biomass and pamphlets to disseminate information on the potential uses of residual forestry biomass as well as the diverse types of equipment for users/consumers of biomass showing the expected profitability. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy Security; I&R&C

MAIN INSTRUMENTS
RNC2050; PAESC-RAM

SOURCES OF FUNDING
Community Funds (PO SEUR, Regional Ops, OP Madeira)

ENTITY RESPONSIBLE
MAAC; MA; GRM; GRA; DGEG; AGIF, I.P.; Municipalities

ACTION STRATEGY

6.1. PROMOTE THE PRODUCTION AND USE OF RENEWABLE ENERGY SOURCES IN AGRICULTURE AND FORESTRY

DESCRIPTION
Increase the production and use of renewable sources of energy in the agriculture and forestry sectors, in coordination with the line of action to promote the decarbonisation of industry pursuant to Target 7, for agroindustry, and the bioeconomy line of action of the said target.

SECTOR(S)
Agriculture; Forestry; Industry; Energy

ACTION MEASURES
To promote the production and use of renewable energy sources in agriculture and forestry, the following action measures are planned:

6.1.1. Promote the installation and reconversion of equipment to produce and use thermal and electric energy from renewable sources in agriculture and forestry ventures

The technological solutions to be adopted include installing renewable sources (e.g. solar panels, wind power) to use in agriculture and forestry facilities and equipment (e.g. intensive livestock, irrigation equipment). [Expected date: 2020-2030]

6.1.2. Increase the use of alternative fuels and other national resources with potential to be used as an energy source

Promote and stimulate the use and penetration of renewable energy sources, particularly biomass and biofuels. [Expected date: 2020-2030]

6.1.3. Promote the installation of equipment to produce thermal/electric energy by using biomass and biogas or biomethane

The implementation of such production systems will be encouraged considering the existence of the potential to use biomass and biogas or biomethane produced in agricultural and forestry ventures. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; R&I&C

MAIN INSTRUMENTS
RNC2050; future PEPAC, ENEAPAI 2018-2025, Relationship Monitoring Platform in the Agro Feedstuffs Chain (PARCA), Relationship Monitoring Platform in the Forestry Sector (PARF)

SOURCES OF FUNDING
EAFRD; Cohesion Fund; ERDF

ENTITY RESPONSIBLE
MAAC; MA; GRA

ii. Estimated excess production of energy from renewable sources which could be transferred to other Member States

Not applicable.

iii. Specific measures relating to financial support

See 5.3(iii).

iv. Specific measures to introduce one or more one-stop-shops, streamline administrative procedures, provide information and training, and facilitate the implementation of power purchase agreements

ACTION STRATEGY
8.4. PROMOTE INFORMATION FOR CONSUMERS AND COMPANIES, CONTRIBUTING TOWARD BETTER ENERGY LITERACY AND SIMPLIFYING INTERACTION WITH THE MARKET

DESCRIPTION
The energy sector and climate issues are complex and often communicate in a language that is not understood by everyone. As a result, citizens are often unaware of the available options. This is why it is important to promote energy literacy for consumers by means of more transparent information and greater dissemination of knowledge on energy and climate. This will enable citizens to make more informed choices and promote more and better information for consumers, contributing toward transparency and competition in the energy market. A more informed consumer represents better, more efficient and sustainable choices and a consumer at the centre of decision making is a more active consumer in energy transition, and one that is available to participate in the structural changes required to meet this challenge.

SECTOR(S)
Civil society; Companies

ACTION MEASURES
The following action measures are planned to promote information for consumers and companies, contributing toward a better energy literacy and simplifying interaction with the market:

8.4.1. Promote more and better local services for consumers
Electronic services and platforms do not reach all consumers, particularly those who are more vulnerable and those who have less access to such services. Thus, dissemination must also involve local services for consumers such as the 'Loja do Cidadão' (citizens bureau) and similar structures. [Expected date: 2020-2030]

8.4.2. Promote the simplification and uniformity of energy bills by defining the minimum requirements in terms of content and structure
A clearer and simpler energy bill contributes significantly toward improving consumer understanding of the price structure of various energy products, enabling consumers to adopt more efficient behaviour to reduce their energy bill. [Expected date: 2019-2030]

8.4.3. Support and develop new platforms to promote energy literacy
Disseminate the current platforms and promote the appearance of new and better platforms that use new information technology to take significant steps in terms of communicating with the public, maximising the growing awareness and desire of citizens to use new technologies. Examples of such platforms include the Information Centre for Energy (CINERGIA) – and the Energy Observatory. [Expected date: 2020-2030]

8.4.4. Promote and develop new platforms to improve interaction with the market Promote and disseminate the use of the Save Energy website, with a view to facilitating changing suppliers in the retail market. [Expected date: 2020-2030]
CONTRIBUTION TO THE 5 DIMENSIONS Decarbonisation; Energy Security; Internal Market
MAIN INSTRUMENTS EEF; Community Funds (PO SEUR, Regional OPs)
SOURCES OF FUNDING Community Funds
ENTITY RESPONSIBLE MAAC; GRA; DGEG; APA; ADENE

v. Assessment of the need to build new district heating infrastructures from renewable energy sources

Not applicable.

3.1.3. Other items

i. National policies and measures affecting EU ETS

The sectors covered by ETS (particularly the electricity generation and industrial sectors) are regulated at a European level and as such, the policies and measures that were identified focus primarily on sectors that are not covered by ETS. Nevertheless, several of these measures identified directly or indirectly affect sectors identified by ETS and the following lines of action are particularly worthy of note, described in Chapter 3.1.1:

- 1.1: PROMOTING THE DECARBONISATION OF THE ELECTRICITY GENERATION SECTOR
- 1.2: APPLYING EU ETS
- 1.7. PROCEEDING WITH GREEN TAXATION
- 7.3 FOMENTING ECO-INNOVATION AND CLEANER PRODUCTION PROCESSES, PROMOTING THE DIGITALISATION OF INDUSTRY (INDUSTRY 4.0)
- 7.1 PROMOTING THE DECARBONISATION OF INDUSTRY

ii. Policies and measures to achieve other national targets

These elements have been identified, when relevant, in the respective chapters and sub-chapters.

iii. Policies and measures to achieve low emission mobility (including electrification of transport)

The path toward energy transition and carbon neutrality undoubtedly involves the transport sector, aiming to completely decarbonise the road and railway sectors in the medium and long-term. Improving efficiency while using resources also encompasses mobility. To this end, it is necessary to encourage shared means of transport and the use of less polluting vehicles. It is also essential to make public transport more attractive, offering comfort, quality, speed and integrated and easy access, favouring intermodal connections and, whenever possible, in conjunction with soft transport measures.

ACTION STRATEGY

5.1. PROMOTE MODAL TRANSFERS FOR PUBLIC TRANSPORT

DESCRIPTION

Making public transport more attractive and favouring modal transfers will make it possible to reduce urban congestion and achieve more efficient and clean mobility, affording greater comfort, speed and quality of life with lesser energy consumption. The objective is to provide citizens with a more comfortable, high-quality public transport service that is quicker and offers easy access, thus contributing toward fomenting social cohesion and maximising accessibility for all citizens. The aim is to promote modal transfers by improving supply and access to public transport; reducing dependence on individual forms of transport for everyday journeys.

SECTOR(S)

Transport

ACTION MEASURES

The following action measures are planned to promote modal transfers:

5.1.1. Tariff Reduction Support Programme

Promote and maintain the tariff reduction support programme (PART), contributing toward reducing costs associated with collective public transport, thus increasing its accessibility. [Expected date: 2020-2030]

5.1.2. Expand public transport networks and equipment throughout Portugal

Promote the extension of the high-capacity collective public transport network and maintain the dynamic of continuing to expand these systems. Of note among the scheduled projects is the expansion of the metro systems in Lisbon and Porto. [Expected date: 2020-2030]

5.1.3. Actions to promote multimodal intercity public transport

Improve the quality of service, tariff integration, intermodal transfers and information for the public, with a view to increasing the share of public transport among different modes of transport. [Expected date: 2020-2030]

5.1.4. Implementation of an integrated information and ticketing system

Implement integrated information and ticketing solutions in the Autonomous Region of Madeira for public transport and complementary services, based on new real-time information technologies and electronic forms of payment, specifically adapted for the resident population, young people and tourists. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation; Energy efficiency

MAIN INSTRUMENTS

RNC2050; PNI; PART; PIETRAM; PAMUS-RAM

SOURCES OF FUNDING

State Budget; Community Funds (PO SEUR, Regional OPs); EF; RAM Budget

ENTITY RESPONSIBLE

MAAC; MIH; Intermunicipal Communities; Metropolitan Areas; Transport Authorities; GRM; GRA; IMT

ACTION STRATEGY

5.2. STIMULATE THE ENERGY TRANSITION OF THE TRANSPORT SECTOR

DESCRIPTION

Achieving the decarbonisation of the transport sector is crucial to achieving the energy and climate targets for the 2030 and 2050 horizons, as Portugal has defined a goal of 20% of energy share from renewable sources of energy in the transport sector as early as the next decade. The aim is to ensure effective energy transition and energy efficiency gains in all transport sectors, guaranteeing the use of clean energies, such as electricity, advanced biofuels and hydrogen.

SECTOR(S)

Transport; Energy

ACTION MEASURES

To stimulate energy transition in the transport sector, the following action measures are planned:

5.2.1. Renew bus fleets

The fleet of buses circulating in Portugal has an estimated average age of 16 years old, contributing significantly toward increased GHG emissions and, more particularly, the degradation of air quality in urban areas. It is thus important to continue to encourage the renovation of fleets by co-funding 'clean buses', particularly in relation to electricity and hydrogen. [Expected date: 2020-2030]

5.2.2. Incorporate and use environmental performance and low-carbon criteria in the process of contracting public service passenger transport concessions

Pursuant to Regulation (EC) 1370/2007 of the European Parliament and of the Council of 23 October 2007 on public passenger transport services by rail and by road, all collective passenger public transport services in national territory must be associated with a contract to provide concessions for services issued by transport authorities to operators. It is important for the contracting process to include environmental performance criteria for the vehicle fleet, in keeping with Community guidelines, particularly Directive (EU) 2019/1161 of the European Parliament and of the Council of 20 June 2019, amending Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles, which sets out minimum targets for each Member State with regard to public contracting for a percentage of non-polluting light and passenger vehicles. [Expected date: 2020-2030]

5.2.3. Improve passenger rail transport

Improve the frequency and quality of passenger rail services to increase the use of this means of transport in place of individual transport, by investing in new rolling stock. [Expected date: 2020- 2030

5.2.4. Renew the passenger ferry fleet

The passenger ferry fleet operating in Portugal is relatively old. It is thus important to encourage the use of ships and vessels powered by clean alternative fuels for transport and other maritime activities, with emphasis on the electrification of short distance fluvial passenger transport. [Expected date: 2020-2030]

5.2.5. Promote the use of renewable sources of energy in transport fleets

By revising the Regulations for Managing Energy Consumption in the Transport Sector, include benefits for using renewable fuels in fleets, thus encouraging companies to incorporate renewable sources of energy into their fleets. [Expected date: 2020-2030]

5.2.6. Study the conversion of diesel railway equipment to green hydrogen, to circulate on non-electrified lines

Hydrogen has the potential to play a very important role in decarbonising railway transport, as an alternative to the electrification of lines, avoiding costs and reducing the environmental impact of such operations. To this end, it is important to study the potential for converting diesel equipment to hydrogen on a national scale, followed by the implementation of a pilot-project. [Expected date: 2020-2025]

5.2.7. Revise the Transport Energy Efficiency Regulations

The Transport Sector Energy Consumption Management Regulations (RGCEST) are used in the transport sector. These regulations aim to improve energy efficiency in the transport sector and apply to both transport companies as well as companies that have their own energy intensive fleets, and establish goals to progressively reduce specific energy consumption. Considering the role and dimension of the sector, there is clear opportunity to create new requirements and goals for transport companies and companies that have their own energy intensive fleets. This will ensure the harmonisation of different legal instruments in force as well as update and promote the use of legislation for energy consumption in the sector. [Expected date: 2020-2021]

5.2.8. Introduce cleaner forms of energy for the ferry between Madeira and Porto Santo

Renovate the passenger and vehicle ferry between Madeira and Porto Santo, introducing cleaner and more efficient forms of energy. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation; Energy efficiency

MAIN INSTRUMENTS

RNC2050; PIETRAM; PAMUS-RAM

SOURCES OF FUNDING
State Budget; Community Funds (PO SEUR, Regional OPs); EF; RAM Budget

ENTITY RESPONSIBLE
MAAC; DGEG; IMT; Public Transport Operators; GRM; GRA

ACTION STRATEGY
5.3. PROMOTE AND SUPPORT ELECTRIC MOBILITY

DESCRIPTION
Electric mobility is a decisive factor to ensure the gradual substitution of fossil fuels in road transport with renewable electricity, contributing to GHG emissions reduction. It is therefore important to promote and support electric mobility, by encouraging the introduction of electric vehicles and reinforcing the charging infrastructure.

SECTOR(S)
Transport; Services

ACTION MEASURES
To promote and support electric mobility, the following action measures are planned:

5.3.1. Establish a new model for electric mobility
Portugal has an innovative model to manage the electric vehicle charging network, which has significant benefits for consumers. The network has complete interoperability among different electric power retailers thus increasing the efficiency and availability of the charging network. This model is already implemented for part of the network, namely, for fast charging outlets, and it is essential to expand this to the entire public access active network. [Expected date: 2020-2025]

5.3.2. Foment efficient electric mobility in Madeira and Porto Santo
Renew the public transport fleets, taxi fleet, logistics services fleets and other transport fleets, as well as private vehicles, promoting transition to efficient electric mobility though financial and tax incentives, among other measures.

In Porto Santo, incentives are being offered as part of the Sustainable Porto Santo – Smart Fossil Free Island initiative to acquire electric vehicles, offered by the Regional Government. This scheme will later be extended to the island of Madeira. [Expected date: 2019-2030]

5.3.3. Maintain and promote incentives to acquire 100% electric light vehicles, as well as the existing framework of tax incentives
Since 2015 Portugal has had a number of highly competitive incentives for acquiring electric vehicles, with an acquisition subsidy of EUR 2 250, as well as tax exemptions for vehicles, supplementary taxation on vehicles and road tax. Provided that the cost of acquiring an electric vehicle is significantly higher than a comparable traditional combustion vehicle, it is necessary to guarantee and even expand the existing framework of incentives. [Expected date: 2020-2025]

5.3.4. Promote electric vehicles for urban micro-logistics
Urban micro-logistics, namely 'last mile' goods transportation has the potential to use zero emissions vehicles such as electric vehicles, quadricycles and e-bikes. [Expected date: 2020-2030]

5.3.5. Promote two-wheel electric vehicles
Despite the considerable potential to convert two-wheel vehicles into electric vehicles, the market for electric two-wheel vehicles is still nascent. It is thus important to promote the use of this segment of electric vehicles, financially or through positive discrimination measures. [Expected date: 2020-2025]

5.3.6. Promote the development of the public access charging network
The public access charging network must keep pace with the scale of the stock of electric vehicles in circulation in Portugal. Considering that sales of electric vehicles have increased exponentially between 2016 and 2019, it is important to ensure that the charging network expands to maintain the ratio between vehicles and charging points.

Among the initiatives to reinforce the charging network the following aspects are worthy of note: (i) adopting criteria to make it compulsory to install charging points, namely in residential and commercial areas; (ii) make it compulsory to install charging points for electric vehicles in public access infrastructure [Expected date: 2020- 2025]

5.3.7. Promote the implementation of charging points for electric vehicles in private buildings

Create the technical and regulatory conditions, as well as suitable incentives, to expand the electric vehicle charging network in private buildings. [Expected date: 2020-2025]

5.3.8. Promote the smart charging of electric vehicles with bidirectional energy flows

Create the legal framework for the smart charging of electric vehicles and the use of features that allow bidirectional energy flows with system services on Portugal's autonomous islands, more specifically in car park and public or private charging points, to contribute toward the security of the electricity supply system and increase the penetration of renewable sources of energy on such remote islands. [Expected date: 2020-2030]

5.3.9. Promote the charging of electric buses

Create a charging network for electric buses, for night charging and complementary charging at terminals or parking areas, involving public transport and tourism services. This will help decarbonise the transport sector, minimise the impact on the electricity network and increase the penetration of renewable energy sources on the remote islands. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation; Energy efficiency

MAIN INSTRUMENTS

RNC2050; PNI; PIETRAM; PAMUS-RAM; PAESC-RAM (in preparation); PAESI-Madeira; PAESI-Porto Santo; EMEA; PMEA

SOURCES OF FUNDING

State Budget; Community Funds (PO SEUR, Regional OPs); EF; OP Madeira

ENTITY RESPONSIBLE

MAAC; DGEG; MOBI.E; GRM; GRA; EEM

ACTION STRATEGY

5.4. PROMOTE VEHICLE SHARING SERVICES

DESCRIPTION

In addition to promoting public transport, it is also important to encourage other formats of urban mobility, which make it possible to reduce the pressure on road traffic and reduce GHG emissions, promoting well-being and quality of life. Promote vehicle sharing services with focus on electric mobility and active mobility.

SECTOR(S)

Transport; Services

ACTION MEASURES

To promote vehicle sharing services, the following action measures are planned:

5.4.1. Promote shared mobility initiatives such as car sharing, bike sharing and carpooling

Providing a system to share vehicles is a solution that increases a fleet's efficiency of use. These sharing systems can encompass cars, bicycles, motorcycles and, most recently, scooters. The use of these shared vehicle systems results in reduced environmental impact and high energy efficiency, as well as a reduction in occupation of public space. [Expected date: 2020-2025]

5.4.2. Promote the adoption of tools to support mobility management and information technologies and systems to support mobility and communication

The incorporation of new technologies and smart systems in managing mobility are essential tools to increase logistical efficiency, energy efficiency and environmental efficiency. Furthermore, in our current information society, the process of choosing a mode of transport is greatly conditioned by the availability of real-time information on the conditions of different transport options by integrating smart transport systems and passenger communication systems. [Expected date: 2020-2030]

5.4.3. Promote 'mobility as a service' tools

The concept of mobility as a service consists of providing a service that makes it possible to get from Point A to Point B using the mode of transport that best suits the needs of the passenger and the characteristics of the intended journey. As an alternative to acquiring and owning a vehicle, a single mode of transport, mobility as a service makes it possible to use multiple modes of transport and choose that which that is most efficient for the respective journey. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation; Energy efficiency

MAIN INSTRUMENTS

RNC2050; EMEA; PMEA

SOURCES OF FUNDING

n.s.

ENTITY RESPONSIBLE

MAAC; GRA; IMT; Municipalities; Transport Operators

ACTION STRATEGY

5.5. PROMOTE THE PRODUCTION AND CONSUMPTION OF ALTERNATIVE RENEWABLE FUELS

DESCRIPTION

Clean alternative fuels, particularly advanced biofuels and hydrogen, are an alternative and complementary solution to electric mobility for the 2030 and 2040 horizon, particularly for the heavy goods long haul freight road transport sector, passenger heavy transport, sea cargo sector and aviation sector, to ensure energy transition in these sectors. In the case of advanced biofuels, Portugal also has a significant biofuels industry and the necessary infrastructure.

SECTOR(S)

Transport; Energy; Industry; Waste; Agriculture

ACTION MEASURES

The following action measures are planned to promote the production and consumption of alternative renewable fuels:

5.5.1. Promote the production of advanced biofuels, using national endogenous resources

The national production of advanced biofuels will be achieved by using residual biomass or biomass with negligible economic value, the use of waste such as used cooking oils and other alternative endogenous resources.

The National Plan to Promote Bio-Refineries, approved by Council of Ministers Resolution No 163/2017 will be revised and implemented. This plan aims to reinforce the national use of renewable energy sources by the sustainable use of biomass as an alternative source of energy to fossil fuels, promoting the production of a variety of products, including advanced biofuels and the appearance of new value chains around biomass, in a bio-economy and a circular economy. [Expected date: 2020-2030]

To a large extent, this entails transposing the new Renewable Energy Directive (RED II) during 2020 and defining targets to incorporate advanced biofuels for the 2021-2030 decade. The process of transposing RED II must consider guaranteeing the exception to the 1.7% limit for raw materials set out in Part B of Annex IX. [Expected date: 2020-2021]

5.5.2. Phase-out conventional biofuels

Pursuant to the new Renewable Energy Directive (RED II) the share of biofuels, bioliquids and biomass fuels produced from food crops for human or animal consumption with a high risk of indirectly changing land use must gradually decrease until it reaches 0% by 31 December 2030. To achieve this goal, the necessary changes must be promoted to comply with this rule, promoting the use of advanced biofuels to substitute them. [Expected date: 2021-2030]

5.5.3. Promote richer mixes of bioenergy

Assess current legislation in relation to the quality of fuels, promoting the incorporation of greater percentages of biofuels, particularly with regard to professional diesel. [Expected date: 2020-2022]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy Security

MAIN INSTRUMENTS
RNC2050; PNPB

SOURCES OF FUNDING
EF; FAI; Community Funds (PO SEUR, Regional OPs)

ENTITY RESPONSIBLE
MAAC; DGEG; LNEG; APA

ACTION STRATEGY

5.6. PROMOTE ALTERNATIVE FUEL SUPPLY INFRASTRUCTURE FOR CLEAN FUELS

DESCRIPTION
The transport sector is a priority for defining the policies and measures aimed at promoting the decarbonisation of the economy and society, with significant potential for improvement in terms of diversification of sources of energy and energy efficiency.

SECTOR(S)
Transport; Energy; Waste

ACTION MEASURES
To promote alternative fuel supply infrastructure for clean fuels, the following action measures are planned:

5.6.1. Promote the installation of supply points for 100% renewable liquid and gaseous fuels for public transport and municipal service fleets
The national strategy has included incorporating biofuels into conventional fuels, within the limits of their technical specifications and using the existing infrastructure for these conventional fuels. Focusing on local solutions to use advanced biofuels, biomethane and hydrogen and other renewable fuels, both in a pure state as well as at high concentrations in fossil fuels will include promoting the installation of 100% renewable liquid and gaseous fuels supply points for public transport and municipal service fleets. Preference will be given to locations close to the plants producing these renewable alternatives and projects associated with the use of residual biomass or biomass of little economic value. [Expected date: 2020-2030]

5.6.2. Promote and support the installation of green hydrogen supply points
Green hydrogen's potential as an energy vector enabling the temporary storage of energy has been recognised and it offers considerable flexibility of use. It can even be used as a way of storing electricity produced from renewable sources. Using this synergy with the electricity generation system, this alternative fuel could play an important role in the decarbonisation of the transport sector, where the penetration of renewable energy is a challenge. Thus, it is essential to develop infrastructure to supply hydrogen in order to promote its consumption.

This network will be installed in phases, starting with pilot projects and trials, mainly associated with public transport fleets and logistics distribution, evolving into a network that ensures significant territorial coverage and enables the gradual penetration of hydrogen-powered mobility. [Expected date: 2020-2030]

5.6.3. Promote the development of an infrastructure to supply renewable sources of energy to ships in ports
Promote the use of renewable sources of energy by ships docked at ports, such as electricity or hydrogen, providing an 'On-shore power supply' to vessels in place of conventional fossil fuels to generate energy for internal use. This will make it possible to improve the air quality at these sites as well as contribute toward reducing GHG emissions, if the electricity is produced from renewable sources. [Expected date: 2020-2030]

5.6.4. Revise the National Action Framework to create infrastructure for alternative fuels

Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure established a common framework of measures and minimum requirements to install the said infrastructure at a European level. Member States were required to prepare national action frameworks with targets and goals to develop this infrastructure. Portugal approved its National Action Framework to deploy alternative fuels infrastructure by means of Council of Ministers Resolution No 88/2017, which needs to be updated in light of the targets set out in this plan and in RCN 2050. [Expected date: 2020-2021]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation

MAIN INSTRUMENTS

RNC2050

SOURCES OF FUNDING

EF; FAI

ENTITY RESPONSIBLE

MAAC; MIH; DGEG; LNEG

ACTION STRATEGY

5.7. PROMOTE ACTIVE MOBILITY AND MORE EFFICIENT BEHAVIOUR

DESCRIPTION

Promoting active mobility in place of individual motorised transport is a growing trend in developed societies, due to the excellent cost-benefit relationship and enormous advantages it offers in fundamental areas for the quality of life – even for people who are not (yet) engaging in active mobility. Promoting the use of bicycles, in particular, must be contemplated in an objective, systematic, transversal and ambitious manner. The progressive availability of e-bicycles makes it possible to expand and generalise the benefits derived from adopting active mobility in society and there are strong reasons to adopt new forms of mobility and improve the use of the transport system. Measures will thus be implemented to promote active mobility and more efficient behaviour, increasing the modal share of bicycle and pedestrian journeys.

SECTOR(S)

Transport; Cities

ACTION MEASURES

To promote active mobility and more efficient behaviour, the following action measures are planned:

5.7.1. Implement the National Strategy for Active Mobility 2020-2030

Portugal has enormous potential for active mobility, which must be used and promoted for the common good. However, to achieve levels of success comparable to other European countries, it is essential to be creative and innovative while implementing policies, adapting international best practices to national and local contexts.

In 2030, any person in Portugal will be able to choose to walk or cycle for commutes. To achieve this aim, it will be necessary to mobilise a large number of different agents for this national project, which can contribute toward developing an active society, which values, supports and celebrates all forms of pedestrian and bicycle mobility: on road and off road, for everyday trips, recreational activities and sports. To ensure greater efficiency and effectiveness while using available resources, it is important to establish a result-oriented action plan centred on end users (pedestrians and cyclists) to maximise the return on investment.

The objectives of the National Strategy for Active Mobility (*Estratégia Nacional para a Mobilidade Ativa* - ENMA) are: (i) increase the modal share of bicycle journeys in Portugal; (ii) increase the modal share of bicycle journeys in cities; (iii) increase the active modal share (bicycle and pedestrian) in Portugal; (iv) increase the total extension of cycle tracks; (v) reduction of road accidents involving pedestrians and cyclists. [Expected date: 2020-2030]

5.7.2. Cycle Portugal Programme 2030

The Cycle Portugal Programme 2030 is an incentive to expand infrastructure dedicated to the use of bicycles as a mode of transport that can play a relevant role as a sustainable solution to respond to many of the mobility needs of the urban population, both in the two large metropolitan areas in mainland Portugal as well as in suburbs and cities.

This programme envisages the construction of 1 000 km of cycle tracks by 2030 ensuring the expansion and upgrading of cycle and pedestrian networks, improving their connectivity. [Expected date: 2020-2030]

5.7.3. Increase incentives for active mobility

Maintain and increase the incentives to promote active mobility, bicycles and other light vehicles, namely, electric versions. [Expected date: 2020-2030]

5.7.4. Promote the use of bicycles and other active modes with a view to increasing the share of soft modes of transport

Promote the adoption of behaviour favouring active modes, particularly the use of bicycles. This will entail an integrated marketing and communications effort – including continuous and consistent awareness campaigns, events and activities that have an impact and education promoting active modes of transport and road behaviour – oriented to encourage a profound shift in attitudes. [Expected date: 2020-2030]

5.7.5. Promote the use of bicycles by changing the mobility behaviour in school and/or university age segments of the population

Education for an active and sustainable road mobility will be taught from pre-school level and continued over subsequent levels, encouraging the shared and responsible use of public space. Resources, initiatives and communications campaigns will be developed and promoted for groups with different needs and expectations, where there is significant potential to increase the use of active mobility, such as, for example, among students. [Expected date: 2020-2030]

5.7.6. Create a network of complementary equipment to support active mobility

Provide suitable parking for bicycles at all relevant points (safe, well-located and in sufficient quantity). Bicycle transport must tend to be practical and accessible, on rail transport, river transport and, in some situations, road transport, e.g. in the case of intercity and urban journeys. [Expected date: 2020-2025]

5.7.7. Improve pedestrian infrastructure

Implement measures that facilitate pedestrian traffic in consolidated urban areas, facilitating the safe circulation of pedestrians and reducing bottlenecks resulting from difficult terrain and limited space in some urban streets, in the Autonomous Region of Madeira. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
RNC2050; ENMA 2020-2030

SOURCES OF FUNDING
State Budget; Community Funds (PO SEUR, Regional OPs); EF

ENTITY RESPONSIBLE
MAAC; GRA; IMT

ACTION STRATEGY

5.8. PROMOTE GOODS TRANSPORT BY RAIL AND SEA

DESCRIPTION
Goods freight is one of the main contributors for the consumption of fossil fuels and for GHG emissions in the transport sector, namely, due to the high modal share of road transport. Promoting transportation by sea and rail will result in a significant increase in the energy and environmental efficiency of goods transport.

SECTOR(S)
Transport

ACTION MEASURES
To promote goods transport by rail and sea, the following action measures are planned:

5.8.1 Increase the competitiveness of railway transport
Reduce the transit time and cost of transport (€/km/container), increase capacity (number and length of trains). [Expected date: 2020-2030]

5.8.2. Improve international connections
Improvements will be made to the following corridors: Sines/Setúbal/Lisbon-Caia; Leixões/Aveiro – Vilar Formoso. The use of rail to and from national ports will be promoted. [Expected date: 2020-2030]

5.8.3. Create conditions for railway interoperability
Promote the electrification of signalling. Increase the length of goods trains to 750 m and at the level of gauge promote the installation of (multi-purpose) crosspieces that make it possible to change gauge on international corridors.
[Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
RNC2050; PNI

SOURCES OF FUNDING
Community Funds (PO SEUR, Regional OPs)

ENTITY RESPONSIBLE
MIH

iv. National policies, timelines and measures envisaged to gradually eliminate energy subsidies, particularly for fossil fuels

To ensure that taxation is an instrument for the transition to carbon neutrality, in 2018 Portugal created a Working Group[25] to analyse taxation impacting energy. The task of this group was to identify and study incentives that were detrimental to the environment and propose their gradual elimination, as well as to frame proposals to revitalise the carbon tax, considering the possible impact on the economic sectors affected in decarbonising the economy.

A phased process of eliminating the exemptions associated with the use of coal to produce electricity is described below.

Elimination of exemptions for the use of coal to produce electricity

The National Budget for 2018 (Art. 251) sets out the phased elimination of the exemptions for the Petrol and Energy Products Tax (*Imposto sobre Produtos Petrolíferos e Energéticos* - ISP) applicable to coal and coal coke used for cogeneration and to produce electricity.

Thus, in 2018 coal and coal coke (classified as codes NC2701, 2702 and 2704) used to produce electricity and heat are now subject to a tax corresponding to 10% of the ISP rate and 10% of the add-on rate for CO_2 emissions (carbon tax). These rates are to be amended on 1 January every year in the following manner: (i) 25% in 2019; (ii) 50% in 2020; (iii) 75% in 2021; (iv) 100% in 2022.

The revenue obtained from this gradual elimination of the ISP exemption and add-ons for CO_2 emissions is split, with 50% being allocated to the National Electricity System (NES) to reduce the tariff deficit for the electricity sector affecting the Fund for the Systemic Sustainability of the Energy Sector and 50% being allocated to the Environmental Fund to be used for decarbonisation projects.

An adjustment was introduced for 2019, which makes it possible to reflect the price of carbon that plants have already paid and it also set a base price of 20 €/t to determine the carbon tax.

[25] Official Order No 2835/2018, published in the Official Journal, 2nd series, No 56 of 20 March 2018

An analysis of tax expenditure for ISP identified that in 2017 around EUR 441 M was associated with tax incentives for fossil fuels.

In the context of the Energy Taxation Directive, there are optional exemptions, such as the case of those for energy intensive industries. It is important to note that even though this Directive sets out that Member States should exempt fossil fuels used to produce electricity it also establishes that they can be taxed for environmental policy reasons.

Portugal thus intends to continue to eliminate subsidies that are detrimental to the environment, reinforcing the use of the carbon tax and promoting greater taxation for the use of resources and, as is the case today, the revenues obtained thus will be recycled for decarbonisation and fair transition.

ACTION STRATEGY
1.7. IMPLEMENT GREEN TAXATION

DESCRIPTION
Contribute toward encouraging more sustainable patterns of production and consumption; promote a reduction in GHG emissions; foster more sustainable behaviours; promote eco-innovation and efficiency in the use of resources; foment entrepreneurialism and the creation of employment; reduce external energy dependence; the efficient implementation of international goals and targets and a diversification of revenue sources.

SECTOR(S)
Energy; Industry; Mobility and Transport; Services

ACTION MEASURES
To implement green taxation, the following action measures are planned:

1.7.1. Taxation to decarbonise the energy sector
Revitalise the carbon tax – a tax on carbon in sectors that are not covered by ETS, with a rate indexed to the price of carbon in the sectors encompassed by ETS. Gradually eliminate the incentives that are detrimental to the environment, namely subsidies for fossil fuels, including revising tax benefits and other incentives associated with the use of fossil fuels. [Expected date: 2020-2025]

1.7.2. Taxation to decarbonise the transport sector and promote sustainable mobility
Incentives for electric mobility through measures impacting Personal Income Tax (IRS), Corporation Tax (IRC), VAT, Vehicle Tax (ISV), supplementary taxation on vehicles or subsidies for purchasing new electric vehicles or plug-in hybrids. Revise the ISV and Road Tax (IUC) to reinforce positive discrimination for vehicles with better environmental performance, maintaining taxation based on CO_2 emissions. Study potential incentives for bio-energy mobility, differentiating bio-energy from fossil fuels, promoting the use of richer bio-energy blends. [Expected date: 2020-2025]

1.7.3. Taxation to decarbonise the residential and services sectors
Introduce tax incentives for energy efficiency and introducing energy from renewable sources and a more favourable tax system for buildings used to produce renewable energy (e.g. create tax incentives, such as reducing property tax (IMI) for buildings that use virtually no energy (NZEB)). [Expected date: 2020-2025]

1.7.4 Taxation to promote low-carbon products and services
Create tax incentives for low-carbon products and services, namely, those that are certified or incorporate recycled material. [Expected date: 2020-2025]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
RNC2050; Green Taxation

SOURCES OF FUNDING
n.s.

ENTITY RESPONSIBLE
MF; MAAC; GRA

3.2. Dimension Energy efficiency

Energy efficiency is one of the most important factors in achieving the transition to a carbon neutral economy, while also generating growth, employment and investment opportunities. This is why energy efficiency is not only an opportunity for development and modernisation, but is also viewed as a priority source of energy in the sense that energy that is not produced/consumed is the safest, cleanest and cheapest energy. This vision is in keeping with Community policy as the EU has defined 'Energy efficiency first' to be one of the main guidelines for its energy policy.

i. Compulsory energy efficiency schemes and alternative policy measures in accordance with Articles 7- A and 7-B of Directive 2012/27/EU (revised)

ACTION STRATEGY
2.2. PROMOTE MORE EFFICIENT EQUIPMENT

DESCRIPTION
The objective is to make the current stock of equipment (electric appliances and electronic equipment) more efficient by direct substitution as well as disincentives for purchasing new equipment with significantly lower energy and environmental performance to the best practices in the market. This can be achieved by encouraging a change in behaviour in the acquisition of such equipment and energy consumption.

SECTOR(S)
Residential, Services

ACTION MEASURES
To promote more efficient equipment, the following action measures are planned:

2.2.1. Promote the substitution of inefficient electric equipment
Through a specific programme designed for the purpose, promote the substitution of home appliances and other inefficient electric equipment essentially for domestic use, thus reducing the specific consumption of the domestic equipment stock. [Expected date: 2020-2021]

2.2.2. Promote adequate dissemination of information and communication for the new generation of energy labels due to the implementation of Regulation (EU) 2017/1369
The new generation of labels resulting from the implementation of the new energy labelling system for different types of home appliances, electronics, lighting and climate control will start appearing on products and in stores at the end of 2020 and early 2021, as well as later dates (2025 and 2030), pursuant to the legislation governing each type of product. The scale of the new labels translates into a rescaling of previous labelling. To ensure the success of this new generation of labels it is essential to focus on careful, coherent and effective information and communication for consumers so that they have more knowledge in this regard, contributing toward their energy literacy. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
n.a.

SOURCES OF FUNDING
EEF; PPEC

ENTITY RESPONSIBLE
MAAC; GRA; DGEG; ADENE

ACTION STRATEGY
2.3. ENSURE IMPROVEMENTS IN THE MANAGEMENT OF ENERGY CONSUMPTION IN THE DIFFERENT SECTORS OF THE NATIONAL ECONOMY;

DESCRIPTION
Significantly improve energy consumption management by reducing the consumption and costs associated with company operations and managing domestic economies. This will contribute substantially toward increasing the competitiveness of the economy and different sectors, freeing resources to promote internal demand and new investments.

SECTOR(S)
Residential; Services, Industry; Transport; Agriculture and Fisheries

ACTION MEASURES
The following action measures are planned to improve energy consumption management in diverse sectors of the national economy, in addition to the action measures set out in Target 1 - DECARBONISE THE NATIONAL ECONOMY, Target 6 – PROMOTE SUSTAINABLE AGRICULTURE AND CARBON SEQUESTRATION and Target 7 – DEVELOP AN INNOVATIVE AND COMPETITIVE INDUSTRY:

2.3.1 Promote the creation of an Energy Efficiency and Consumption Management System
Create a common and transversal system with universal records, sectorial reports and monitoring of energy consumption, duly integrated with existing systems (SGCIE, SCE, ECO.AP Barometer, among others). This system will make it possible in a simple and integrated manner to meet reporting and audit obligations and different action/rationalisation plans according to the sector and level of energy consumption, promoting harmonisation and the simplification of procedures. [Expected date: 2020-2021]

2.3.2 Promote the optimisation and resilience of water services
Increase the resilience of public water supply systems by improving their performance, particularly in relation to reducing water losses. Increase the resilience of wastewater sanitation systems, by eliminated undue connections, adapting WWTPs to extreme climate phenomena and reusing treated wastewater. Increase the resilience of storm water drainage systems, by eliminating undue leaks, lowering flows during periods of intense precipitation and reusing rain water. Reduce the energy consumed by water services by improving energy and water efficiency and increasing the level of energy self-sufficiency at WWTPs and other facilities. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
SCE; SGCIE; ECO.AP

SOURCES OF FUNDING
n.s.

ENTITY RESPONSIBLE
MAAC; GRA; DGEG; ADENE

ACTION STRATEGY
6.4. IMPLEMENT MORE EFFICIENT PRACTICES IN ENERGY AND WATER USE IN AGRICULTURE AND FORESTRY

DESCRIPTION
The objective is to promote more efficient forestry and agricultural practices while using resources and regenerative practices that have an impact on GHG emissions and improving energy and water efficiency in coordination with the line of action for bio-economy within the scope of this target.

SECTOR(S)
Agriculture; Forestry; Energy

ACTION MEASURES
To implement more efficient practices in energy and water use in agriculture and forestry, the following action measures are planned:

6.4.1. Promote energy and water efficiency
This will be achieved by acquiring and using management tools, the installation and use of more efficient technologies (e.g. optimisation of engines, pumping systems, ventilation systems and compression systems, heat and cold recovery, efficient lighting), including precision equipment (e.g. efficient irrigation) and by supporting irrigation best practices (e.g. monitoring, use of the water balance for irrigation decisions, inspections and checking the efficacy of irrigation equipment) and recognising best practices for irrigation equipment for efficient water use, as well as supporting water certification for irrigation equipment. [Expected date: 2020-2030]

6.4.2. Create Energy Efficiency Regulations in Agriculture and Forestry

Considering that there is a clear opportunity to improve energy consumption, this new regulation aims to ensure a rational use of energy in agriculture, forestry and fisheries facilities, reducing unnecessary costs. [Expected date: 2020-2030]

CONTRIBUTION TO THE DIMENSIONS OF NECP
Decarbonisation; Energy Efficiency; R&I&C

MAIN INSTRUMENTS
RNC2050; future PEPAC

SOURCES OF FUNDING
EAFRD; EEF; Cohesion Fund; ERDF

ENTITY RESPONSIBLE
MA; MAAC; GRA

ACTION STRATEGY
7.2. PROMOTE ENERGY AND RESOURCE EFFICIENCY

DESCRIPTION
Promote energy and resource efficiency in the industrial sector, optimising as far as possible the nexus between energy, water and materials efficiency at the level of manufacturing processes. This will increase the productivity of resources, separate the economic growth from using these resources and increase competitiveness.

SECTOR(S)
Industry; Energy

ACTION MEASURES
To promote energy and resource efficiency, the following action measures are planned:

7.2.1. Promote the implementation of more efficient technologies
Optimising engines, pumping systems, ventilation systems and compression systems, combustion systems, heat recovery, industrial cold. Similarly promote efficient lighting. [Expected date: 2020-2030]

7.2.2. Promote highly-efficient cogeneration based on renewable sources of energy
Considering its potential for significant savings of primary energy and its preferential use by industries that are intensive consumers of energy, highly-efficient cogeneration will continue to be promoted. To this end, highly-efficient cogeneration systems and those that use renewable resources will be increased, making it possible to improve the cost of production, thus ensuring that industry is more competitive, while simultaneously contributing toward achieving energy and climate goals. [Expected date: 2020-2030]

7.2.3. Review the Energy Efficiency Regulations for Industry
With respect to the industrial sector, the System to Manage Intensive Consumption of Energy (*Sistema de Gestão dos Consumos Intensivos de Energia* – SGCIE) is in force, which aims to promote energy efficiency and monitor the energy consumption of these facilities. It is applied to plants that are intensive consumers of energy. Considering the role and size of this sector, there is clear opportunity to create new requirements and goals for the industrial sector. [Expected date: 2019-2021]

CONTRIBUTION TO THE DIMENSIONS OF NECP
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
RNC2050; ENAR; SGCIE; PRAEE

SOURCES OF FUNDING
EEF

ENTITY RESPONSIBLE
MAAC; METD; GRA

ii. Long-term strategy for the renewal of the national residential and non-residential building stock, both public as well as private[26]

[26] Including policies, measures and actions to stimulate significant cost-effectiveness and policies and actions to reach the most poorly performing segments of the national building stock, in accordance with Article 2-A of Directive 2010/31/EU on the energy performance of buildings, amended by Directive 2018/844.

ACTION STRATEGY

2.1. PROMOTE THE ENERGY RENEWAL OF BUILDING STOCK AND NZEB BUILDINGS

DESCRIPTION

The objective is to mobilise the necessary efforts to promote energy efficiency by renovating and rehabilitating buildings. Rehabilitating buildings and making them more efficient will make it possible to simultaneously achieve various objectives including reducing energy bills, reducing emissions and improving levels of health and comfort. This is why the energy renovation of buildings must be considered as a priority.

SECTOR(S)

Residential, Services

ACTION MEASURES

To promote the effective renewal of the building stock, the following action measures are planned:

2.1.1. Promote a long-term strategy for the renewal of buildings

Develop and implement a long-term strategy that enables the promotion of building renovation, contributing to an increase in energy efficiency of the building stock and changing the paradigm of recent decades, which has focused solely on new construction, contributing in turn to an increase in the quality of the existing building stock, which is increasingly in need of urgent action to raise comfort levels and generate energy efficiency gains. This strategy will include: surveying the national stock of real estate; identifying economically feasible approaches for renovations that are relevant for the different types of buildings; identifying policies and measures to encourage in-depth renovations of buildings; future perspectives for the sector; estimate of energy savings and other possible benefits. A multidisciplinary working group can be created to monitor the implementation of this strategy. [Expected date: 2020]

2.1.2. Update the Buildings Energy Certification System (*Sistema de Certificação Energética dos Edifícios* - SCE)

Updating the SCE, with respect to transposing Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018, amending Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (EPBD), will serve diverse purposes, including recording and monitoring actions implemented in buildings and their technical systems. In this regard, in response to some of the new requirements of the EPBD, the energy certification of buildings is expected to reinforce the integration of diverse information: recording the technical solutions that characterise buildings and opportunities for improvement; providing end users with energy certificates, thus enabling easy access to this document for the diverse contexts in which it is needed; recording maintenance operations and inspections for the technical systems of buildings; records of operations to install, substitute or upgrade technical systems in buildings; recording the energy consumption of large commercial and service buildings; reinforcing interoperability with other public administration systems and platforms.

Updating SCE will also contribute toward improving the information available to consumers, through accessible and transparent advisory resources, preferably digital platforms, such as support counters or platforms that bring together supply and demand for solutions to improve energy efficiency, such as one-stop-shops, the implementation of renovation passports or platforms to register works relating to buildings that have an impact on energy performance. [Expected date: 2020-2021]

2.1.3. Provide a new version of the Energy Certificate

In keeping with the new requirements of the EU directive on the energy efficiency of buildings, the image and role of energy certification for buildings will be reinforced, with the introduction of a new version that is also aligned with the expectations of the target audience. Specifically, as the new energy certificate will be easier for citizens to understand it will provide greater clarity on the characteristics and performance of their buildings, both by means of qualitative assessments – in place of quantitative assessments – as well as by creating references that can be assimilated more easily, such as level of comfort indicators, thus complying with the objectives of an energy efficiency policy for buildings.

The new certificate is likewise the path to follow for any improvements that are implemented as well as the corresponding impact of these improvements. The planning and priority of these measures is in keeping with the strategy to be implemented for rehabilitation. This will firstly involve reducing energy needs and then act with respect to technical systems, including those that use renewable energy.

In the context of reinforcing the role of energy certification, this document is expected to: support assessments of the energy performance of buildings and compliance with the applicable requirements at the time of the respective issuance or renewal, in a manner that is adapted to the new European legislative context; help support periodical assessments of the energy performance of large commercial and service buildings, with a view to identifying opportunities for improvement; prior support for consumers in juridical matters and transactions involving buildings, by providing detailed information on energy performance and the building's components, as well as opportunities for improvement; help owners identify opportunities for improvement in buildings and implementing them; help support access to funding instruments, helping identify the state of the building and improvement needs, and, subsequently, accompanying, monitoring and validating the implementation of measures to improve energy efficiency; help support the conferring of tax benefits, encouraging the implementation of improvements, as well as designing or renovating buildings with a view to achieving a high energy performance. [Expected date: 2020-2021]

2.1.4. Review the Energy Efficiency Regulations for Residential and Service Buildings (public and private)

These regulations aim to promote energy upgrades for public and private residential and service buildings, ensuring greater comfort and quality for their users.

Reviewing these regulations, by transposing the energy performance of buildings Directive, is aimed at the following objectives, among others: (i) promote solutions that are capable of improving the energy performance of buildings, contributing toward reducing energy demand, the need for heating and cooling and to improve the energy performance of buildings; (ii) promote highly efficient alternative systems that safeguard compliance with NZEB requirements; (iii) define requirements in the charging infrastructure for electric mobility; (iv) adapt buildings to integrate smart technologies, such as automation and electronic monitoring of the building's technical system; (v) inspect lighting and heating and cooling systems; (vi) promote documentation and records for the installation, substitution or upgrading of technical systems; (vii) ensure greater transparency in methodologies for calculating the energy performance of buildings, by suitably adapting existing standards. [Expected date: 2020-2021]

2.1.5. Promote NZEB buildings

Buildings that have negligible energy needs, known as NZEB, are characterised by having a very high energy performance and having very low or almost no energy needs. They are largely covered by energy from renewable sources, whether produced on site or nearby.

Promoting the implementation of the NZEB concept in new buildings, through a realistic strategy that is suitable for Portugal's climatic, cultural and economic situation, will ensure that increases in Portugal's building stock will be based on low energy consumption and the promotion of energy from renewable sources. Since implementing the NZEB concept will establish a new paradigm, the involvement of the main players from the construction sector will be promoted. It will be necessary to establish measures that encourage these players to adopt this paradigm, along with studies and the dissemination of a portfolio of technical solutions that enable new and existing buildings to gradually achieve the level of NZEB. In the case of existing buildings, guidelines must similarly be established to support rehabilitation projects that advocate monitoring consumption, the implementation of efficient and durable equipment and optimising consumption in a sustainable manner, promoting the understanding and suitability of existing mechanisms in the specific context of these buildings and their potential. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
RNC2050; PRAEE

SOURCES OF FUNDING
Community Funds (PO SEUR, Regional OPs); Casa Eficiente 2020; EEF; IFRRU 2020; Renovate to Rent Programme (*Programa Reabilitar para Arrendar*); FNRE

ENTITY RESPONSIBLE
MAAC; GRA; DGEG; ADENE

iii. Description of policy 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 models

ACTION STRATEGY

1.5. DECARBONISE GOVERNMENT

DESCRIPTION

Decarbonise public administration in the areas of transport and mobility, buildings and public procurement, leading by example in the implementation of innovative and ambitious policies, providing the public administration with low-carbon mobility options, reducing energy intensity and increasing the efficiency of its transport fleet, promoting a low-carbon building stock and adopting low-carbon requirements for public procurement.

SECTOR(S)

Mobility and Transport; Energy; Public State Sector

ACTION MEASURES

To promote the decarbonisation of government, the following action measures are planned:

1.5.1. Promote the decarbonisation of the building stock of the Central, Local and Regional Public Administration

The Public Administration Energy Efficiency Programme (ECO.AP) will be reviewed to promote the decarbonisation of the stock of state buildings. The ECO.AP review aims to define new goals and targets for this programme, potentially expanding its scope to local and regional public administration. The review will consider the legal framework of the Ministry Interlocutor for the ECO.AP Programme, in the context of the state central administration, and the function of the Local Energy Manager, reformulating the model for implementing Energy Efficiency Management Contracts and promoting funding models that promote economies of scale and reduce the perceived risk associated with energy efficiency investments, the creation of a tax, budgetary and regulatory environment that favours investments in energy efficiency measures by public administration services and bodies, reinforcing mechanisms to monitor and check compliance with the obligations of public administration services and bodies in relation to energy efficiency and energy certification and the inclusion of an emissions reduction aspect as well as the reduction of other resources (e.g. water and paper).

An Energy Efficiency Barometer has been implemented to achieve the objectives set out in the ECO.AP, with a view to characterising, comparing and disseminating the energy performance of different public administration entities. The Barometer plays a central role in the strategy to promote energy efficiency in the public sector, providing detailed information on the structure of the energy consumption of the public sector and helping define policies and measures to promote the efficient use of energy resources in the public sector. This tool will be promoted by developing new functions in the Barometer (upgrading and refining indicators), creating mechanisms to automate energy consumption records for buildings, training and awareness actions and personalised support for the concerned entities. [Expected date: 2020-2023]

1.5.2. Promote the implementation of 'easy win' solutions, energy efficiency and/or incorporation of renewable energy

Solutions to be adopted include promoting the electrification of buildings and an increased use of renewables, by installing thermal solar collectors to heat buildings or high-consumption equipment such as swimming pools, sports facilities, schools and multi-purpose pavilions and the use of more efficient climate control solutions, as well as the installation of solar systems to produce electricity as self-generation. [Expected date: 2020-2030]

1.5.3. Promote ecological public procurement in keeping with the respective National Strategy for Ecological Public Procurement

Incorporate low-carbon requirements in the public procurement of energy services and goods, equipment and buildings, the public purchase of vehicles and transport services as well as in roadworks and public procurement of other goods and services. Furthermore, the option to acquire low-carbon services instead of products (servitization) will also be promoted. [Expected date: 2020-2030]

1.5.4. Promote the introduction and use of low-emissions vehicles and sustainable mobility in the state sector

Promoting increasingly sustainable mobility must begin with state institutions, leading by example in adopting innovative and ambitious policies. By creating the obligations to comply with quotas to acquire electric vehicles for the state administration, as well as incentives to introduce electric vehicles in the fleet of state vehicles, as in the example of the ECO.MOB project, it will be possible to achieve high levels of penetration of electric vehicles in the state fleet. It is thus important to prepare a new programme for sustainable mobility for the public administration to provide continuity for the ECO.MOB project and pursue its objectives.

Mobility management will also be promoted, including promoting the use of public transport and initiatives such as car sharing and carpooling, as well as a shift in behaviours, including the development of eco-driving training actions. [Expected date: 2020-2025]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
RNC2050; ECO.MOB; ECO.AP; ECO.AP Azores; ENAR; ENCPE; PAESC-RAM

SOURCES OF FUNDING
EF; EEF; RAM Budget

ENTITY RESPONSIBLE
MAAC; MF; MIH; GRM; GRA; ESPAP; APA; DGEG; ADENE; Municipalities

ACTION STRATEGY
2.4. PROMOTE ENERGY EFFICIENCY IN PUBLIC LIGHTING

DESCRIPTION
Public Lighting (PL) is responsible for a significant share of electricity consumption, especially in municipalities, corresponding to a substantial annual financial burden. Furthermore, there is considerable potential for energy savings which must be promoted by municipalities. In this regard, it is essential to promote investments in an efficient and modern PL system, which enables necessary levels of lighting for the safety of pedestrians and vehicles, increases energy savings, enables the introduction of new functions and applications to manage and control consumption and enables Smart Cities. Policies will be implemented that promote the development of efficient and modern PL, promoting energy upgrades to achieve energy savings and ensure suitable lighting, pursuant to standards in force for public streets throughout Portugal.

SECTOR(S)
Energy; Municipalities

ACTION MEASURES
To promote energy efficiency in public lighting, the following action measures are planned:

2.4.1. Define a legal system to upgrade and install Public Lighting infrastructure
Given the need to create and apply suitable technical rules, with a proactive and educational attitude, and to aid the work of planners and installers of PL infrastructure, it is important to create and publish a technical manual that covers, as a minimum, the main concepts of lighting technology and criteria for PL projects (including providing calculation tools) based on the EN13201 standard. It is equally important to review, in coordination with APA, the definition of criteria set out in the national strategy for ecological public procurement in the context of public lighting. [Expected date: 2020-2021]

2.4.2. Introduce a Public Lighting Consumption Management system
In coordination with the other measures and to meet the targets set out in Art. 7 of Directive (EU) 2018/2002, which are compulsory, it is important to create a system to manage the energy consumption of public lighting (*Sistema de Gestão dos Consumos da Iluminação Pública* – SGCIP). This will be instituted to promote energy efficiency and to monitor the energy consumption of the national public lighting infrastructure. It is equally important to promote the installation of smart systems to measure consumption. SGCIP will address the requirement to prepare and report records for existing public lighting and an Energy Upgrade Plan for public lighting for the 2030 horizon as well as an annual report on energy savings achieved by the entities responsible for managing this infrastructure. The purpose of the Energy Upgrade Plan for public lighting is to create conditions to improve the quality of lighting in public streets and spaces while also reducing the respective energy consumption. It also promotes records for existing infrastructure and upgrades according to needs on a case-by-case basis. [Expected date: 2020-2025]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
n.a.

SOURCES OF FUNDING
EEF; Community Funds (PO SEUR, Regional Ops); PPEC

ENTITY RESPONSIBLE
GRA; DGEG; Municipalities

iv. Other planned policies, measures and programmes to achieve the indicative national energy efficiency target for 2030, as well as other objectives presented in 2.2.

ACTION STRATEGY
2.5. PROMOTE VOCATIONAL TRAINING FOR THE ENERGY EFFICIENCY SECTOR

DESCRIPTION
Reinforcing the competences and professional qualifications of technicians in the area of energy efficiency makes it possible to comply with the goals and objectives that have been set out at a national and European level, which promote increased energy efficiency for the economy and various sectors, contributing toward the efficient use of resources. Furthermore, professional training and qualifications will be key factors for competitiveness, economic growth and the creation of jobs.

SECTOR(S)
Services; Industry; Energy; Transport

ACTION MEASURES
To reinforce vocational training for the energy efficiency sector, the following action measures are planned:

2.5.1. Promote new disciplines for training specialised technicians for the energy efficiency sector and renewable energies
Of note among the new competences to be promoted are the following fields: (i) Energy Efficiency Plans and Audits, complying with the technical standards to be introduced by the Regulations for Energy Efficiency in Service Buildings, Industry and Transport; (ii) Planning and Installation of Solar Thermal and Solar Photovoltaic Energy, meeting the technical standards defined by the state; (iii) Managing the Energy of Service Buildings, complementing the competences currently set out for Installation and Maintenance Technicians (IMT); (iv) professionalisation and qualification of Public Lighting Planners and Installers; (v) Control Management Systems, to respond to the requirements of the new EPBD directive and the introduction of new technological solutions in buildings; (vi) Measurement & Verification of projects to improve energy efficiency, based on International Performance Measurement and Verification Protocol (IPMVP) methodologies, to suitably quantify avoided consumption and ensure uniform methodologies to assess energy savings. [Expected date: 2020-2030]

2.5.2. Promote training for technicians and specialists in the field of construction and NZEB buildings
Considering the fact that implementing the concept of NZEB will establish a new paradigm, as well as the relevance of linking NZEB buildings and the quality of their construction (to ensure a suitable performance during their life cycle), support will be provided for the technical training of diverse agents, from the project design phase to the construction phase, concluding with the phase of using these buildings. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
n.a.

SOURCES OF FUNDING
n.s.

ENTITY RESPONSIBLE
Ministry of Labour, Solidarity and Social Security (MTSSS); MAAC; GRA; DGEG; ADENE

v. Description of measures to utilise energy efficiency potentials of gas and electricity infrastructure

Not applicable.

vi. Regional cooperation in the field of energy efficiency

Not applicable.

vii. Financing measures, including Union support and the use of Union funds, in the area of energy efficiency at national level

See 5.3(iii).

3.3. Dimension Energy security

Supply security must be ensured by implementing suitable measures to balance supply and demand, namely, measures for the overall technical management of the system, which encourage the diversification of sources of supply and contribute toward the planning, construction and maintenance of necessary infrastructure. Increased interconnection capacity, storage systems (fundamental in an energy system that is essentially based on renewable sources), the implementation of new network planning mechanisms and the dissemination of smart networks, among other measures, will all contribute greatly to this end.

i. Policies and measures relating to energy security

ACTION STRATEGY
4.1. PROMOTE STORAGE SYSTEMS

DESCRIPTION
The existence of storage systems in different forms is considered to be fundamental to better manage the national energy system in its various sub-sectors, playing a crucial role and promoting the flexibility and stability of the national electricity system. It is thus important to continue to focus on reversible pumping systems in hydroelectric plants and try to develop other technological solutions that include using battery technology and technologies associated with hydrogen. A significant part of the new storage capacity will be directly associated with centres generating electricity from renewable sources.

SECTOR(S)
Hydro

ACTION MEASURES
To promote storage systems, the following action measures are planned:

4.1.1. Create the legal framework to implement storage systems
Create a legal framework that makes it possible to promote the implementation of different forms of storage systems, particularly for the electricity sector. [Expected date: 2020-2021]

4.1.2. Create a Roadmap for storage in Portugal
The main objective of this Roadmap is to provide a practical, independent and objective analysis of the various possible trajectories to implement storage systems, aligned with the objectives of renewable sources of energy and decarbonisation, considering the security of supplies, the quality of service and the economic sustainability of the options to be adopted. This document will be updated at least every five years to reflect the evolution in technology and costs. [Expected date: 2020-2025]

4.1.3. Promote the implementation of storage projects associated with centres generating electricity from renewable sources
Support the development of pilot projects that promote the implementation of technologies that are not widespread or have not yet matured, with a view to improving their technical and economic viability, focusing on the association between renewable production and storage. [Expected date: 2020-2025]

4.1.4. Promote storage in the islands
Increase electricity storage capacity in island territories with isolated electricity networks, using reversible hydro systems, batteries, hydrogen and other technologies. Implement smart electricity grids to strengthen the stability and resilience of small-scale isolated electricity systems and increase the penetration of intermittent renewable sources of energy. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy Security; Internal Market; R&I&C

MAIN INSTRUMENTS
RNC2050; PAESC-RAM; PAESI-Madeira; PAESI-Porto Santo

SOURCES OF FUNDING
ERDF; FAI; Community Funds (PO SEUR, Regional OPs); Horizon Europe; Innovation Fund

ENTITY RESPONSIBLE
MAAC; GRM; GRA; DGEG; ERSE; EEM; Regional Agency for Energy and the Environment of the Autonomous Region of Madeira (AREAM)

ACTION STRATEGY
4.4. PROMOTE THE DIGITALISATION OF THE ENERGY SYSTEM

DESCRIPTION
Promoting energy transition in the energy sector will therefore entail a new model for transmission and distribution networks, based on the pursuit of synergies among the various options, including the rapid and gradual expansion and modernisation of infrastructure, reconfiguration and digitalisation of the market.

SECTOR(S)
Energy; Residential; Services; Industry

ACTION MEASURES
To promote the digitalisation of the energy system, the following action measures are planned:

4.4.1 Promote the expansion of smart meters
In an increasingly modern and digitalised energy system, smart meters play a fundamental role in the way information is obtained and used to benefit consumers, providing this information to them, which will enable more dynamic and effective management of the system, favouring energy efficiency, improved supply for consumers and greater efficiency in network operations. To quickly and effectively achieve increasingly higher levels of smart meters in the system, there will be a drive to install smart meters, from an economically viable perspective, promoting the roll-out for all consumers, ensuring better information and the involvement of consumers in the coming years. Access to more accurate information through smart meters will also have a positive impact, for example, on the transparency and reliability of the information as well as of all the agents involved. [Expected date: 2020-2030]

4.4.2. Promote the development of smart grids
The planning for transmission and distribution networks and the respective investments will have an innovative component of high-performance levels based on smart systems. It is thus essential to encourage innovation, pursuant to directives defined for this purpose, which must consider the need to maintain the resilience of systems and networks, mitigating and preventing any impact on security.

The necessary rules and orientations will be defined to this end, in the form of legislation and regulations, to implement the development of smart grids. Access to more accurate information through smart grids will also have a positive impact, for example, on the transparency and reliability of the information as well as of all the agents involved. It is also important to safeguard the information and security of the grids against cybersecurity related phenomena and events. [Expected date: 2020-2030]

4.4.3. Promote the development of a long-term plan to digitalise the energy sector
The energy sector will perforce undergo significant changes over coming years, partly due to the growing digitalisation of the sector. These changes are complex and challenging, both for companies/operators as well as for consumers, and must be studied and anticipated to prepare the system and consumers for the imminent changes in the sector. This new reality could also entail legislative changes to provide a suitable legal framework to enable, for example, the availability of detailed data on consumption and the definition of the respective time frames to create new solutions. [Expected date: 2020-2025]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy Efficiency; Energy Security; Internal Market; R&I&C

MAIN INSTRUMENTS
PNI

SOURCES OF FUNDING
EFC Mechanism

ENTITY RESPONSIBLE
MAAC; METD; GRA; DGEG; ERSE

ACTION STRATEGY

4.5. PROMOTE SUITABLE PLANNING FOR THE NATIONAL ENERGY SYSTEM ON A PATH TO ENERGY TRANSITION

DESCRIPTION

Increase installed capacity to produce electricity from renewable sources of energy, including distributed production and self-generation. It is also necessary to promote other sources of renewable energy that are currently not widespread in the various sectors. This requires a response at the level of network infrastructure that not only accommodates this increase in capacity and diversification of sources but also all the challenges that the new paradigm of the energy supply and demand represents for the national electricity system. The National Natural Gas System also faces a similar challenge as renewable gases will increasingly be incorporated into the system. The coherence of national electricity planning alongside planning on an EU scale are equally important.

SECTOR(S)

Hydro

ACTION MEASURES

To promote suitable planning for the National Energy System, the following action measures are envisaged:

4.5.1. Create a strategic vision for the national electricity network for 2030 and 2050

This action will consist of a technical study for a strategic and architectural vision and roadmap for the national electricity network for the targets set out in NECP. Its main objectives include: (i) presenting a strategic vision for networks; (ii) reflecting on market models for energy transactions and system services; (iii) assessing the long-term security of supplies. [Expected date: 2019 – 2020]

4.5.2. Plan and promote the integrated and joint management of the network, with a regional and trans-border approach

To optimise resources it is extremely important for network management to use a trans-border approach. To this end, dialogue between national and regional network operators must be promoted and supported. At the same time, the interdependence of the electricity system and gas system must also be considered at a national and trans-border level, using a logic of 'sector coupling', which is in keeping with the Community approach and policy. [Expected date: 2020-2030]

4.5.3. Promote ongoing improvements for network planning instruments

The current network planning instruments, in the form of Network Development and Investment Plans (PDIR), must consider the goals and targets set out in NECP and RCN 2050, as well as the need to adapt network investments to prepare the networks for the challenges of energy transition (greater integration of renewables, decentralised production, storage, electric vehicles, flexibility, among others).

While preparing the Network Development and Investment Plans (PDIR), directives will be defined and promoted to continuously improve networks, so that documents can be produced in a more transparent, clear and accurate manner while presenting information, thus facilitating their analysis and the respective implementation of the investments.

The same logic will be applied to the planning for natural gas networks, simultaneously considering the interdependence of the electricity and gas systems, using 'sector coupling', allowing increasingly integrated planning. This approach is in keeping with the Community approach and policy.

It is also crucial to promote dialogue and cooperation among public entities, operators and other involved agents to improve the planning and management/operation of networks. [Expected date: 2020-2030]

4.5.4. Create network planning mechanisms at a local level

The challenge of having adequate network infrastructure to enable effective energy transition is especially critical for the Low Voltage Network (LV) that will cease to be a passive network and will now integrate a set of new concepts, from network intelligence, systems to support management, smart meters, storage, energy management, local production, energy communities, electric vehicles, among others, which are all variables that must be considered while creating the network of the future.

Mechanisms will be created to ensure this transformation, which will enable interlocutors to use the necessary tools to plan LV networks in an efficient and cost-effective manner, ensuring the quality of the service and the security of supplies. [Expected date: 2020-2025]

CONTRIBUTION TO THE 5 DIMENSIONS
Energy Security; Internal Market

MAIN INSTRUMENTS
RNC2050; PDIRT-E; PDIRGN; PDIRD-E; PDIRD-GN; RMSA-E; RMSA-GN

SOURCES OF FUNDING
n.s.

ENTITY RESPONSIBLE
MAAC; GRA; ERSE; DGEG; Network Operators; GRM

ACTION STRATEGY

4.6. CARRY OUT THE NECESSARY RISK ASSESSMENTS, PREVENTIVE ACTION PLANS AND EMERGENCY PLANS FOR THE ENERGY SECTOR

DESCRIPTION
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 sets out the need to prepare Preventive Action Plans and Emergency Plans. The implementation of this regulation also entails assessing risk, the security of supplies and prevention measures and measures for regional emergency situations. These assessments involve surveying risks, defining the probability and impact of certain events that result in greater restrictions and disruptions to national gas systems. The plans to be defined in this regard, based on the information of the risk assessments, define preventive measures with a view to reducing or eliminating the impact of the said events as well as actions in emergency/crisis situations if a given event identified in the risk assessments was to occur. More recently, as part of the 'Clean Energy for all Europeans' legislative package, Regulation (EU) 2019/941 of the European Parliament and of the Council of 5 June 2019 on risk-preparedness in the electricity sector was published, which provides an overview of procedures defined for the gas sector (included in Regulation (EU) 2017/1938 of 25 October 2017).

SECTOR(S)
Hydro

ACTION MEASURES
The following action measures are planned to carry out the necessary risk assessments, preventive action plans and emergency plans for the energy sector:

4.6.1. Promote and foment regional cooperation for risk and emergency matters

In the natural gas sector, in order to define national and common (regional) risk assessments and preventive action plans and national emergency plans (which also have a regional component) there is a need for increasingly greater and more effective/efficient cooperation among competent national authorities and the respective transmission operators, who are also represented in European forums discussing issues concerning the security of supplies, as is the case of the Gas Coordination Group (organised and coordinated by the European Commission).

In the electricity sector, after the regulation to prepare for risks in the electricity sector was defined, an identical approach to that of the natural gas sector was contemplated. As such, cooperation is viewed similarly, giving equal importance to interaction with counterpart authorities and entities in forums for discussion and cooperation, as is the case of the Electricity Coordination Group (organised and coordinated by the European Commission). [Expected date: 2020-2030]

4.6.2. Promote better coordination among operators and other agents in the sector

To respond to the provisions set out in regulations in force and under preparation in relation to the security of supplies, particularly identifying and assessing risks and preparing plans for prevention and intervention in case of emergency, it is necessary to compile information providing a rigorous description of the respective systems (natural gas and electricity).

Apart from collecting information from operators and other entities and agents operating in the respective systems, it is necessary for them to cooperate closely with each other and with the competent authorities, to obtain assessments and ensure planning that is closer to reality, resulting in greater efficacy and efficiency. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Energy Security; Internal Market

MAIN INSTRUMENTS
PPA SNGN; PE SNGN; PPR SEN

SOURCES OF FUNDING
n.s.

ENTITY RESPONSIBLE
MAAC; DGEG

ACTION STRATEGY
4.7. ADJUST THE ROLE OF NATURAL GAS IN THE ENERGY MIX, FOCUSING ON DECARBONISING THE SECTOR

DESCRIPTION
The path to energy transition over the next decade, 2021-2030, involves a combination of energy technologies and vectors, where natural gas will play an important role. From the perspective of gradually reducing the consumption of fossil fuels, natural gas, which is the fossil fuel with the lowest GHG emissions, will remain as an energy source in the next decade, particularly in electricity generation and industrial consumption. The growing integration of renewable gases and the consequent decarbonisation of the gas sector is a priority. This trajectory, by which the role of natural gas in the energy mix will be adjusted, is directly linked to the evolution of the electrification of consumption and the introduction of renewable gases, particularly hydrogen.

SECTOR(S)
Hydro

ACTION MEASURES
The following action measures are planned to adjust the role of natural gas in the energy mix:

4.7.1 Approach natural gas as an element for flexibility in the electricity generation system
Maintaining the natural gas capacity in the electricity-generation system until at least 2040 will ensure the necessary backup to implement the transition to an electricity system that is widely based on renewable sources, allowing time for the development of technological solutions, with special emphasis on storage, which will give the system the necessary resilience to guarantee adequate levels of supplies. [Expected date: 2020-2030]

4.7.2. Suitable network planning for energy transition
The current network planning instruments, in the form of the Network Development and Investment Plans (PDIR), will consider the goals and targets set out in NECP as well as the need to adapt network investments to prepare them for the challenges of energy transition (increased electrification, greater integration of renewables, particularly renewable gases, among others). [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Energy Security; Internal Market

MAIN INSTRUMENTS
RNC2050; PDIRGN; PDIRD-GN; RMSA; PAESC-RAM

SOURCES OF FUNDING
n.s.

ENTITY RESPONSIBLE
MAAC; GRM; DGEG; ERSE

ACTION STRATEGY
4.8. PROMOTE THE DIVERSIFICATION OF SOURCES AND SUPPLY ROUTES FOR ENERGY RESOURCES

DESCRIPTION
With regard to supply security, it is crucial to diversify sources and routes to supply energy resources, without, however, undermining decarbonisation targets. Even though Portugal has reasonable diversification, there is still considerable concentration, with preferred routes for energy supplies. It is thus important to improve the diversification and/or reduce the concentration of the origin of energy resources.

SECTOR(S)
Energy

ACTION MEASURES
To promote the diversification of sources and supply routes for energy resources, the following action measures are planned:

4.8.1 Promote and reinforce external cooperation in the field of energy
To enable better diversification of sources and routes for energy resources external cooperation with third countries will be strengthened, namely, by means of existing platforms for cooperation or the creation of new platforms, promoting and encouraging the participation of companies operating in the energy sector, to promote closer commercial ties and the possibility of opening up new markets. [Expected date: 2020-2030]

4.8.2. Promote national infrastructure and Portugal's role in European and international energy markets
In the particular case of natural gas, Portugal's potential to operate as one of the main entry points of gas for the European market is recognised, especially Liquefied Natural Gas (LNG) through the Sines LNG Terminal (one of the main deep water ports in Europe, which enables greater diversity in receiving gas tankers). Thus, it is equally important to maintain the national plan to promote interconnections in this sector and, to this end, to reinforce cooperation with Spain, France and the European Commission, namely, through high-level groups on interconnections, particularly the High-Level Group for interconnections in Southwest Europe, created within the scope of the Madrid Declaration. [Expected date: 2020-2030]

4.8.3. Create a sustainable market for maritime LNG, enabling the use of LNG in ships
It is important to consider the possibility of creating a sustainable market for maritime LNG, with Portugal emerging as a transhipment hub for small-scale LNG and as a service area for LNG ships. Increasing the environmental sustainability of a port can include promoting LNG in the port system.

The Strategy to Increase the Competitiveness of the Mainland Commercial Ports Network envisages a series of investments in infrastructure, including supplying LNG to ships. It is important to note that on 1 January 2020, the new international regulations (IMO – International Maritime Organization 2020) enter into force, which benchmark the type of fuels that can be used for maritime transport and require a significant reduction in the sulphur content of the fuel oil used by ships. In this regard, LNG is a potential alternative fuel.
[Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Energy security

MAIN INSTRUMENTS
PNI

SOURCES OF FUNDING
EFC Mechanism; EFSI

ENTITY RESPONSIBLE
MAAC; MM; GRA; DGEG

ii. Regional cooperation in this area

The previous subparagraph sets out action measures to reinforce regional cooperation with respect to interconnections, at the level of new instruments to manage the national electricity system and at the level of the planning and integrated and joint management of the network, with a regional and trans-border logic.

iii. Financing measures in this area at national level, including Union support and the use of Union funds

See 5.3(iii).

3.4. Dimension Internal energy market

3.4.1. Electricity infrastructure

i. Policies and measures to achieve the targeted level of interconnectivity

ACTION STRATEGY
4.2. PROMOTE THE DEVELOPMENT OF INTERCONNECTIONS

DESCRIPTION
Reinforce electricity interconnections with Spain and study the creation of alternatives to the current interdependence between the Portuguese and Spanish electricity markets, particularly by assessing the interconnection with other markets, which will make it possible to strengthen supply security and promote greater integration of the electricity market.

SECTOR(S)
Hydro

ACTION MEASURES
To promote the development of interconnections, the following action measures are planned:

4.2.1. Reinforce regional cooperation
Pursue close coordination with a view to monitoring interconnection projects, assessing the corresponding funding requirements and supervising progress so as to define a new roadmap for their implementation. It is particularly important to reinforce regional cooperation through the High-Level Group on Interconnections for South-West Europe (both to foster and promote interconnections between Portugal and Spain as well as between Spain and France), and strengthen cooperation through such platforms. [Expected date: 2020-2030]

4.2.2. Implement the new interconnections that have already been identified
Implement the new electricity interconnection between Portugal (Minho) and Spain (Galicia), which will be achieved by constructing a new 400-kV dual aerial line between Beariz (ES) – Fontefria (ES) – Ponte de Lima (PT) – Vila Nova de Famalicão (PT), including new 400-kV substations at Beariz, Fontefria, in Spain, and Ponte de Lima, in Portugal. This project has been labelled a Project of Common Interest (PCI) by the European Commission. [Expected date: 2020-2021]

4.2.3. Implement new projects to strengthen the network internally
Some network reinforcement projects aim to increase interconnection capacity and reduce possible negative impacts caused by limitations of interruptions in energy supplies. To this end, two projects to strengthen the internal network will be implemented which the European Commission has classified as PCI, namely: (i) Internal line between Pedralva and Sobrado (PCI 2.16.1); (ii) Internal line between Vieira do Minho, Ribeira de Pena and Feira (PCI 2.16.3). These projects seek to increase the national electricity network's transmission capacity, essentially from renewable sources, in the Minho region, particularly hydro and wind power. They are also related to the new Minho-Galicia interconnection, allowing excess production to be channelled to this network.

The following are equally relevant for implementing the goals for 2030: obtaining economic and environmental benefits from the integration of new RES, reducing production costs and increased competition in the market; reducing CO_2, emissions, contributing toward greater sustainability of the European electricity system; obtaining complementarity between different technologies to generate power from renewable sources (namely hydro and wind power); promoting complementarity between the Portuguese and Spanish electricity systems; avoiding the reduction of interconnection capacity and, consequently, lower levels of competitiveness among agents. [Expected date: 2020-2030]

4.2.4. Promote cooperation and identify new interconnection projects
Considering that interconnection projects to be implemented in the near future (by 2021) will enable Portugal to achieve an interconnection capacity of between 10% and 15%, it is important to contemplate and study new interconnection projects to comply with the 15% goal for interconnection by 2030. This task of identification and implementation will be carried out jointly by the Transmission Network Operators (TSOs) and Distribution Network Operators (DSOs) in Portugal and Spain as well as by the respective competent authorities and regulatory entities. [Expected date: 2020-2030]

4.2.5. Promote the interconnection of isolated insular electricity systems

Promote inter-island electricity interconnections as a tool to optimise generation and storage resources and infrastructure, maximise the use of renewable energies and improve the resilience and stability of small isolated electricity systems. [Expected date: 2020-2030]
4.2.6. Promote market integration
To achieve more integrated markets in the energy sector, it will be important to develop a regulatory framework that promotes such integration by guaranteeing competitiveness among market agents. Defining the regulatory and legal framework will similarly meet the challenges raised by new Community legislation, derived from the clean energy package for all Europeans, particularly instruments associated with designing and configuring the market. [Expected date: 2020-2030]
CONTRIBUTION TO THE 5 DIMENSIONS Decarbonisation; Energy Security; Internal Market
MAIN INSTRUMENTS PDIRT-E; PAESC-RAM; PNI
SOURCES OF FUNDING EFC Mechanism; EFSI; EIB
ENTITY RESPONSIBLE MAAC; GRM; GRA; DGEG; ERSE; EEM; ORT

ii. Regional cooperation in this area

With regard to regional cooperation in electricity interconnections, the Lisbon summit of July 2018 led to a commitment by Portugal, Spain and France to:

- pursue close coordination with a view to monitoring interconnection projects, assessing the corresponding financing requirements and supervising progress so as to define a new roadmap for their implementation;
- build the necessary infrastructures for implementing an efficient and decarbonised internal energy market. This is particularly important with respect to the cross-border interconnections for electricity networks in Member States which have not yet reached a minimum level of integration into the internal energy market, as is the case with Spain and Portugal.
- develop Euro-Mediterranean cooperation in energy and work with regional partners in the development of interconnections, more specifically exploring the potential to produce energy from renewable sources and increase energy efficiency, for the mutual benefit of the economies and peoples of the EU and neighbouring States to the south and east of the Mediterranean.

Also resulting from the II Energy Interconnection Summit were the following planned measures:

- finalise interconnection projects, including the electricity interconnection through the Bay of Biscay, Cantegrit-Navarra and Aragón-Marsillon, (France and Spain) and the interconnection between Portugal and Spain between Vila Fria-Vila do Conde-Recarei (Portugal) and Beariz-Fontefría (Spain);
- accelerate work to prepare and identify sources of funding under the European framework to assess and implement new electricity interconnection projects between France and Spain;
- identify and introduce additional reinforcements into existing networks so as to fully use electricity interconnection capacity.

In November 2018, the Valladolid Declaration was signed by Portugal and Spain in which both Governments actively support the Lisbon Declaration signed on 27 July 2018 and reiterated their objectives to work to achieve interconnections allowing a fully operational internal energy market to be achieved which is safe, competitive and clean.

With the aim of meeting the challenge to incorporate renewable energies and the development of MIBEL, both governments reaffirmed the importance of the internal and external MIBEL interconnection.

iii. Financing measures in this area at national level, including Union support and the use of Union funds

See 5.3(iii).

3.4.2. Energy transmission infrastructure

i. Policies and measures to achieve the key infrastructure objectives, including, if applicable, specific measures to enable the delivery of Projects of Common Interest (PCIs) and other key infrastructure projects

The II Energy Interconnection Summit led to a commitment by Portugal, Spain and France to revise the Implementation Plan to execute the current PCIs and to identify, as quickly as possible, new or alternative projects required to overcome the interconnection shortage between the Iberian Peninsula and France, without delaying compliance with interconnection targets.

ii. Regional cooperation in this area

With regard to regional cooperation in electricity interconnections, the Lisbon Summit led to a commitment by Portugal, Spain and France to build the necessary infrastructures for implementing an efficient and decarbonised internal energy market. This is particularly important with respect to the cross-border interconnections for gas and electricity networks in Member States which have not yet reached a minimum level of integration into the internal energy market, as is the case with Spain and Portugal.

In accordance with the results of this summit, Portugal, Spain and France agreed to define common guidelines to promote the efficient use of networks.

3.4.3. Market integration

i. Policies and measures relating to market integration objectives

At the Valladolid Summit and in the respective Declaration, Portugal and Spain reaffirmed the importance of the MIBEL internal and external interconnection required to meet the challenge to incorporate renewable energies and develop the Iberian Electricity Market (MIBEL). It was also established that work would continue to finalise the Iberian Natural Gas Market (MIBGAS).

ACTION STRATEGY **4.9. PROMOTE INTEGRATION INTO THE INTERNAL EUROPEAN ENERGY MARKET**
DESCRIPTION In addition to developing the necessary infrastructure to strengthen market integration, creating the necessary technical and operational conditions, it is also important to develop common rules at a regional and European level, as well as to define markets and hubs so that costs associated with providing energy (electricity, natural gas and renewable gases) are uniform and, consequently, enable the respective prices to be harmonised.
SECTOR(S) Hydro

ACTION MEASURES
To promote integration into the internal European energy market, the following action measures are planned:

4.9.1 Adapt regulations to promote the reconfiguration and redesign of the market
It will be necessary to adapt national legislation and regulations, based on the evolution of European legislation and regulations, with regard to reconfiguring and redesigning the market (created as part of the 'Clean Energy for All Europeans' legislative package that, under the heading 'Market Design' and with regard to the theme of this measure, highlighted the publication of the new Regulation on the Internal Electricity Market and Internal Market in Electricity Directive) and the use of network codes associated with the respective sectors (electricity, natural gas and renewable gases). This new regulation envisages changing the role of some market agents as well as defining tariffs and other costs that impact on energy prices. [Expected date: 2020-2030]

4.9.2. Create conditions to harmonise and link with other European energy markets/hubs
In the particular case of the natural gas and renewable gases sector, in addition to the development and improvement of the functioning of the Iberian Natural Gas Market (MIBGAS), it is also necessary to develop closer ties between this market and other European hubs, so as to improve its liquidity and make Portugal, and the Iberian Peninsula, an important player in the European energy market. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Energy Security; Internal Market

MAIN INSTRUMENTS
n.a.

SOURCES OF FUNDING
n.s.

ENTITY RESPONSIBLE
MAAC; DGEG; ERSE

ii. Measures to increase the flexibility of the energy system with regard to renewable energy production, including the roll-out of intraday market coupling and cross-border balancing markets

Not applicable.

iii. Measures to ensure the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets

ACTION STRATEGY
4.3. PROMOTE THE INTRODUCTION OF NEW MANAGEMENT INSTRUMENTS INTO THE NATIONAL ELECTRICITY SYSTEM

DESCRIPTION
In light of a series of significant changes that will lead to a liberalised and 'non-vertical' market model, the responsibility for ensuring the security of supplies is shared by the various agents and it is thus important to define each of their roles. In this new model, all agents, including producers, operators, retailers, consumers and political and regulatory institutions, are decisive elements in the process of guaranteeing supplies. These changes in the market context make it necessary to redesign the electricity market and some of its instruments.

SECTOR(S)
Energy; Industry

ACTION MEASURES
To promote the introduction of new management instruments into the national electricity system, the following action measures are planned:

4.3.1. Regulate the figure of the Market Aggregator
This new figure will act within the scope of the NES and aims to resolve supply shortcomings in the aggregation service market. The market aggregator will be obliged to acquire energy produced by power plants that wish to sell it the said energy under a special system covered by the general remuneration scheme, and will also be required to place such energy on the market.

This figure can also acquire energy produced by power plants under a special scheme, covered by the guaranteed remuneration scheme, as well as energy produced by units covered by small-scale distributed production. [Expected date: 2020-2021]

4.3.2. Revise the regulatory and market framework in relation to system services

At a European level, the entire process associated with system services is undergoing profound changes with a view to harmonising the current national markets into markets operating on single European platforms, for each of the different types of reserves, using a model of direct negotiations. Existing incentives to guarantee output that contribute toward maintaining the availability of the electricity production capacity (Ministerial Implementing Order No 41/2017 of 27 January 2017) and invest in new production capacity (investment incentives – Ministerial Implementing Order No 251/2012 of 20 August 2012), with sufficient levels to ensure the security of supplies and interruptibility services (Ministerial Implementing Order No 592/2010 of 29 July 2010), complementary system services aimed only at consumption, will also be revised pursuant to the publication of the new European Parliament and Council Directive on common rules for the internal electricity market and new European Parliament and Council regulations on the internal electricity market. [Expected date: 2019-2021]

4.3.3. Study and promote the introduction of the figure of the Demand Aggregator

This new figure will operate within NES and aims to resolve shortcomings in market supply using aggregation services. The aim of the demand aggregator is to group together different agents/entities, such as end users, small producers, storage, charging points for electric vehicles or any combination of these elements, acting as a single entity and participating in the electricity market and supplying system services. This mechanism promotes system flexibility, improves system management in terms of supply security and promotes greater participation of agents in the market. [Expected date: 2020-2025]

4.3.4. Promote the adaptation of the new European regulatory framework

The 'Clean Energy for All Europeans' legislative package approved new legislation in relation to 'Market Design', particularly the new Regulation on the Internal Electricity Market, setting out all the new requirements for new producers that may be directly or indirectly responsible for programming, with production forecasts for generation facilities. This situation needs to be implemented into the Portuguese electricity system. [Expected date: 2020-2025]

CONTRIBUTION TO THE 5 DIMENSIONS
Energy Security; Internal Market

MAIN INSTRUMENTS
n.a.

SOURCES OF FUNDING
n.s.

ENTITY RESPONSIBLE
MAAC; GRA; DGEG; ERSE

The operating model for the European Intraday Market, based on continuous intraday trading, will allow energy trading between agents located in the different countries/price zones with implicit capacity allocation.

To achieve this objective, several market operators and European system operators are implementing the Cross-Border Intraday Market Project (XBID), which provides the basic contract infrastructure for the systems and procedures on which the pan-European continuous intraday market will be implemented. This market will permit electrical power to be traded up to 60 minutes before delivery, thus allowing renewable energies to be integrated.

Portugal has been part of this new mechanism since it entered into operation (2018).

With the publication of Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing, system services markets managed by European system operators

need to be coordinated. To ensure the implementation of the abovementioned regulation, European system operators are currently cooperating.

- Imbalance Netting – a process for the real-time mutual exchange of imbalances of interconnected European electricity systems. It is expected that Portugal will join this process in 2019;
- Replacement Reserves – Based on the TSO-TSO model, the main aim is to establish and operate a centralised platform capable of compiling all Replacement Reserve (RR) offers from the different national markets operated by each TSO and conduct an optimised allocation of interconnection offers and capacity to satisfy, up to 30 minutes before real time, any differences between scheduled operations in daily and intraday markets and generation and consumption forecasts. This mechanism is expected to start operation at the end of 2019 and Portugal will participate immediately;
- Manual frequency restoration reserves – Based on the TSO-TSO model, the main aim is to establish and operate a centralised platform capable of compiling all manual Frequency Replacement Reserve (mFRR), offers from the different national markets operated by each TSO and conduct optimised allocation to satisfy needs, both before and in real time It is expected that Portugal will comply with the deadlines set out in Regulation (EU) 2017/2195 of 23 November 2017, i.e. Portugal will be integrated into this new mechanism in 2021;
- Automatic Frequency Restoration Reserves – Based on the TSO-TSO model, the main aim is to establish and operate a centralised platform capable of mobilising in a coordinated an economically efficient manner, energy balancing offers relating to Automatic Frequency Restoration Reserves (aFRR) from the different national markets operated by each TSO and conduct optimised allocation of interconnection capacity to satisfy the needs of each TSO in real time It is expected that Portugal will comply with the deadlines set out in Regulation (EU) 2017/2195 of 23 November 2017, i.e. Portugal will be integrated into this new mechanism in 2021;

The expected benefits of the abovementioned processes are:

- An increase in efficiency and competition in system services markets in the different systems;
- Greater coordination of the different system services markets and improved possibility for exchanging systems services, thus optimising the operating security of the systems involved;
- Facilitate electricity integration from renewable energy sources.

iv. Policies and measures to protect consumers, especially vulnerable consumers and to improve the competitiveness and contestability of the retail energy market

See point 3.4.

v. Description of measures to enable and develop demand response including those addressing tariffs to support dynamic pricing

As already mentioned, in February 2018, ERSE approved the rules for implementing, as of 1 June 2018, two pilot-projects, including the introduction of dynamic tariffs for access network access in mainland Portugal. Participation in the pilot-projects, intended only for industrial consumers, is voluntary and will cover 100 consumers per pilot-project, over 12 months. Based on the results of the pilot-projects, ERSE will conduct a cost-benefit analysis to assess the merits for the electricity system and the possible setting of specific targets for installing smart meters.

3.4.4. Energy poverty

It is essential to ensure that the process of decarbonisation and energy transition take place in a fair, cohesive and inclusive manner and thus the steps taken over the next decade must not accentuate energy poverty, rather, solutions must be found to mitigate this problem. Situations of energy poverty must be identified and obviated through diverse measures, including urban rehabilitation and promoting energy efficiency and renewable sources of energy.

It is also necessary to examine the economic and social aspects of this transition, including the possibility of creating new clusters and assessing the most affected sectors and developing policies to create conditions for their development and anticipate suitable territorial or social responses with regard to education, training and professional redeployment, to guarantee fair transition.

ACTION STRATEGY
8.1. ENSURE FAIR TRANSITION

DESCRIPTION
Anticipate potential positive and negative impacts, at a social, economic and environmental level, associated with decarbonisation and energy transition in the medium and long-term, promoting the creation of new jobs and clusters and planning specific measures to ensure fair transition for companies, workers and communities in general, by focusing on new business models, education, professional training and upskilling.

SECTOR(S)
Transversal

ACTION MEASURES
To ensure fair transition, the following action measures are planned:

8.1.1. Prepare a Fair Transition Strategy

Develop a Fair Transition Strategy that aims to identify and highlight the opportunities and risks associated with decarbonisation and energy transition on the path to carbon neutrality by 2050, as well as identify possible sources of funding that ensure fair transition in economic, social and environmental aspects.

This Strategy will be prepared in conjunction with relevant entities, including representatives of central and local government, representatives from the energy, environment, industry, economy, jobs and academic sectors. It will be framed in keeping with developments at a Community and international level in relation to fair transition. This Strategy will also be transversal, encompassing all sectors of activity, and will consider the interests of companies, workers and the communities where they are located as well as the interests of society in general that need to be safeguarded in the context of a transition that is necessary but aims to be fair and integrating, while also promoting national competitiveness.

This Strategy will thus be the basis for developing specific Action Plans, such as the Action Plan to end the generation of electricity from coal as set out in Target 1 – DECARBONISE THE NATIONAL ECONOMY [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation

MAIN INSTRUMENTS
RNC2050

SOURCES OF FUNDING
EF

ENTITY RESPONSIBLE
MAAC; METD; MTSS; MCT; GRA; GRM

ACTION STRATEGY
8.2. FIGHT ENERGY POVERTY AND IMPROVE INSTRUMENTS TO PROTECT VULNERABLE CUSTOMERS

DESCRIPTION
Energy poverty has an impact not just on the well-being and comfort of citizens but also on health, mortality, school performance, the professional income of adults and social isolation of families and young people. It is thus important to design and develop inclusive strategies to fight energy poverty and increase the efficient consumption of energy among the population living in underprivileged socio-economic conditions and info-exclusion, by promoting various kinds of actions, including grassroot actions among affected citizens. To effectively fight energy poverty, it is necessary to have in-depth information on the national situation to be able to direct measures more effectively. This is the case with the rehabilitation of buildings, promoting renewable energy and communications and education campaigns. With the consumer as an informed and active agent in the market, and with instruments to protect more vulnerable consumers, a further strategic priority for 2030 will be addressed, that of fighting energy poverty and consumer vulnerability.

SECTOR(S)
Domestic

ACTION MEASURES
To fight energy poverty and improve instruments to protect vulnerable customers, the following action measures are planned:

8.2.1. Promote a long-term strategy to fight energy poverty

Approve a long-term Strategy to fight energy poverty, which improves knowledge of this problem, seeking to provide better solutions and implement structural changes to mitigate it.

This strategy will be prepared in conjunction with relevant entities, including entities from central and local government, consumer associations, representatives of the energy sector and academia. Its objective is to diagnose and characterise the problem, develop monitoring indicators, monitoring strategies, establish targets to reduce energy poverty in the medium and long-term, on a national, regional and local level, and propose specific measures to achieve these targets, as well as forms of funding.

The implementation of this strategy will be monitored by a multidisciplinary work group created for the purpose. [Expected date: 2019-2021]

8.2.2. Establish a national system to assess and monitor energy poverty, including the number of families facing energy poverty

It is essential to identify the factors that lead to situations of energy poverty to understand the causes that structurally or contextually influence or cause energy poverty. In addition to recognising these factors, there is a need to implement clear methods to measure energy poverty, as this will provide a basic tool to implement a concerted and successful strategy to protect vulnerable consumers.

To effectively monitor the progress of actions to fight energy poverty and, particularly, the situation of citizens facing this challenge it is important to know the number of families living in energy poverty as well as their main characteristics (composition, income level, etc.) and their geographic concentration to establish an effective and robust national system to assess and monitor energy poverty. [Expected date: 2020- 2021]

8.2.3. Implement mechanisms to protect vulnerable consumers and study the introduction of new mechanisms

Implement mechanisms that make it possible to reduce the energy costs of domestic consumers, helping ensure that the price of energy is not a factor for exclusion in access to these services, irrespective of the economic, social or geographic situation of consumers. This will simultaneously ensure universal access to quality services at accessible prices. Among these mechanisms, the Energy Social Tariff has had a substantial impact on promoting economic accessibility.

It is also necessary to implement measures to protect vulnerable consumers or consumers with serious health problems, making it impossible for energy retailers to disconnect households if bills are paid late. This is important to protect vulnerable clients in Portugal considering current levels of energy poverty and the occurrence of increasingly extreme climate phenomena.

Forms of support that enable vulnerable consumers to participate in energy communities and collective self-generation will also be promoted. [Expected date: 2019-2030]

8.2.4. Develop programmes to promote and support energy efficiency and integrate renewable energy to mitigate energy poverty

Promote more structural support programmes, actions and mechanisms to fight situations of energy poverty, such as incentives to change consumption patterns, actions aimed at promoting investments in energy efficiency, rehabilitation of buildings and programmes that aim to integrate renewable energies. These support mechanisms will be developed in conjunction with municipalities to be better suited to the local situation and promote closer interaction with consumers facing energy poverty. [Expected date: 2020-2030]

8.2.5. Promote and support local strategies to fight energy poverty

Local energy strategies aimed at fighting energy poverty will be supported and encouraged following a logic of proximity and greater reach for policies to mitigate this problem. [Expected date: 2020-2030]

8.2.6. Disseminate information to mitigate energy poverty

The field of complementary measures includes structural measures oriented toward promoting awareness and access to relevant information to support decision-making. The dissemination of relevant information will make it possible to increase the knowledge of consumers in relation to their rights/duties and provide all available information on energy tariffs and social support available in the market. In this regard, the availability of information and tools to compare prices among different operators and campaigns to disseminate relevant information on the energy market are especially important. Despite being an indirect form of intervention, providing consumers with comprehensive knowledge of energy markets and all the support tools available plays a fundamental role in changing consumption patterns and can be a measure to minimise energy poverty. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy efficiency

MAIN INSTRUMENTS
n.a.

SOURCES OF FUNDING
EEF; FAI; EF

ENTITY RESPONSIBLE
MAAC; METD; MTSS; GRA; DGEG; RNAE; Energy Agencies

3.5. Dimension Research, innovation and competitiveness

i. Policies and measures related to the elements set out in point 2.5

ACTION STRATEGY
1.9. PROMOTE R&D PROJECTS SUPPORTING THE TRANSITION TO A CARBON NEUTRAL ECONOMY

DESCRIPTION

Support the development of low-carbon technologies, practices, products and services in all sectors of activity and support the participation of national companies and bodies in research and innovation programmes that contribute toward decarbonising the Portuguese economy.

SECTOR(S)
All sectors

ACTION MEASURES
To promote R&D&I projects supporting the transition to a carbon neutral economy, the following action measures are planned:

1.9.1 Promote liaison with Themed Research and Innovation Agendas by the Science and Technology Foundation (FCT)
FCT Agendas seek to mobilise experts from R&D institutions, companies and public entities to identify challenges and opportunities in the national scientific and technological system, from a medium and long-term perspective, contributing to the development of R&I which provides solutions to problems or needs in different sectors of society. The following Agendas are worthy of note in terms of supporting R&I projects that contribute toward decarbonising the economy: Climate Change, Sustainable Energy Systems, Circular Economy, Urban Science and Cities of the Future (in addition to all the other agenda identified under other objectives). This liaison includes Collaborative Laboratories as their aim is to implement research and innovation agendas. [Expected date: 2020-2030]

1.9.2 Innovation and development of low-carbon technologies, practices, products and services in all sectors of activity
Promote projects for low-carbon technologies, eco-innovation and R&D projects that support the transition to a carbon neutral economy, reducing transition costs. Support the development of innovative and low-carbon products and services and the creation of living labs for decarbonisation, supporting initiatives that bring together research centres, academia and companies. [Expected date: 2020-2030]

1.9.3. Support participation in the Innovation Fund (NER 450)
Promote this programme and create conditions for participation by national companies. [Expected date: 2020- 2025]

1.9.4. Support participation in the Horizon Europe and LIFE Programmes, among others
Promote these programmes and create conditions for participation by national companies. [Expected date: 2021- 2027]

CONTRIBUTION TO THE DIMENSIONS OF NECP
Decarbonisation; Energy Efficiency; R&I&C

MAIN INSTRUMENTS
RNC2050; Agendas FCT

SOURCES OF FUNDING
EF; LIFE; Horizon Europe; Innovation Fund

ENTITY RESPONSIBLE
MCTES; MAAC; GRA; GRM

ACTION STRATEGY
2.6. STIMULATE R&D&I IN THE AREA OF ENERGY EFFICIENCY

DESCRIPTION
Support the development of technologies, practices, products and services that make it possible to promote greater and better energy efficiency in various aspects (buildings, transport, industry, among others), as well as to support the participation of national companies and bodies in research and innovation programmes that promote energy efficiency.

SECTOR(S)
Industry; Services; Buildings; Residential

ACTION MEASURES
To stimulate R&D&I in the area of energy efficiency, the following action measures are planned:

2.6.1. Stimulate research and innovation in the area of energy efficiency.

Promote energy efficiency projects for new residential buildings and thermal and energy rehabilitation (encourage the implementation of sustainable solutions, local resources, innovative materials), solutions and strategies for integrating renewable energy systems, storage and management of consumption and information. [Expected date: 2020-2030]

2.6.2. Promote liaison with Themed Research and Innovation Agendas by the Science and Technology Foundation (FCT)
FCT Agendas seek to mobilise experts from R&D institutions, companies and public entities to identify challenges and opportunities in the national scientific and technological system, from a medium and long-term perspective, contributing to the development of R&I which provides solutions to problems or needs in different sectors of society. This liaison includes Collaborative Laboratories as their aim is to implement research and innovation agendas. [Expected date: 2020-2030]

CONTRIBUTION TO THE 5 DIMENSIONS
Decarbonisation; Energy Efficiency; R&I&C

MAIN INSTRUMENTS
n.a.

SOURCES OF FUNDING
EEF; FCT; Community Funds

ENTITY RESPONSIBLE
MCTES; GRA; DGEG; LNEG; ADENE

ACTION STRATEGY
3.8. ENCOURAGE R&D&I IN RENEWABLE ENERGIES, STORAGE, HYDROGEN, ADVANCED BIOFUELS AND OTHER 100% RENEWABLE FUELS

DESCRIPTION
Support the development of technologies that provide new solutions to use renewable sources of energy, as well as to support the participation of companies and national bodies in research and innovation programmes that contribute toward promoting renewable energy.

SECTOR(S)
Energy; Transport

ACTION MEASURES
The following action measures are planned to encourage R&D&I in renewable energies, storage, hydrogen, advanced biofuels and other 100% renewable fuels:

3.8.1. Promote liaison with Themed Research and Innovation Agendas by the Science and Technology Foundation (FCT)
FCT Agendas seek to mobilise experts from R&D institutions, companies and public entities to identify challenges and opportunities in the national scientific and technological system, from a medium and long-term perspective, contributing to the development of R&I which provides solutions to problems or needs in different sectors of society. The following Agendas are worthy of note in terms of supporting R&I projects that contribute toward renewable energies: Sustainable Energy Systems and Urban Science and Cities of the Future. This liaison includes Collaborative Laboratories as their aim is to implement research and innovation agendas. [Expected date: 2020-2030]

3.8.2. Promote national R&D programmes to support technological development
Of note among the programmes are the following: Low-carbon technologies at a pre-competitive phase, such as Concentrated Solar Power (CSP), Deep Geothermal Energy and Wave Power; Energy Storage; Hydrogen as an energy source; Renewable fuels and bioenergy; sustainable transport; Renewable Energy Conversion Technologies; Performance Improvement, Cost Reduction, New Materials and Optimisation of O&M.

Projects to develop studies characterising the potential for using and integrating renewable energy in urban environments, low-carbon solutions, strategies and technologies on different scales (building, neighbourhood, city, region) and for various typologies will also be promoted. [Expected date: 2020-2030]

3.8.3. Promote a collaborative laboratory for renewable gases
Bring together companies in this sector, research centres and universities in a collaborative laboratory that contributes toward creating national scientific and technological knowledge that promotes the specialisation of the Portuguese economy in this segment, which has great economic potential and technological value. [Expected date: 2020-2025]

3.8.4. Promote training for technical specialists

Developing activities associated with renewable energies, storage, hydrogen, advanced biofuels and other 100% renewable fuels will involve specialised training needs, encompassing various levels of training. It is thus important to identify training needs based on the expected development of the sector, in partnership with the entities responsible for the education system and professional training. [Expected date 2020-2025]

CONTRIBUTION TO THE 5 DIMENSIONS

Decarbonisation; Energy Security; I&R&C

MAIN INSTRUMENTS

PAESC-RAM; PAESI-Madeira; PAESI-Porto Santo

SOURCES OF FUNDING

FCT; Horizon Europe; Innovation Fund; Structural Funds; InnovFin Energy Demo Projects

ENTITY RESPONSIBLE

MCTES; GRM; GRA; EEM

ACTION STRATEGY

6.8. PROMOTE R&I&D PROJECTS SUPPORTING THE SUSTAINABLE MANAGEMENT OF AGRICULTURE AND FORESTRY

DESCRIPTION

Support the development of low-carbon technologies, processes, practices, products and services that are efficient in terms of using resources in the agroforestry sector and promote the compilation of more and better base information, which will make it possible to better understand and manage Portugal's agroforestry territory.

SECTOR(S)

Agriculture; Forestry; Circular Economy

ACTION MEASURES

To promote R&I&D projects supporting the sustainable management of agriculture and forestry, the following action measures are planned:

6.8.1. Promote liaison with Themed Research and Innovation Agendas by the Science and Technology Foundation (FCT)

FCT Agendas seek to mobilise experts from R&D institutions, companies and public entities to identify challenges and opportunities in the national scientific and technological system, from a medium and long-term perspective, contributing to the development of R&I which provides solutions to problems or needs in different sectors of society. The following Agenda is worthy of note in terms of supporting R&I projects that contribute toward decarbonising the agroforestry sector: Agri-food, Forestry and Biodiversity Agenda. This cooperation extends to Collaborative Laboratories, since their objective is to implement research and innovation agendas. [Expected date: 2020-2030]

6.8.2. Systematically compile, process and make available information on the forestry sector

The absence of information on a number of basic aspects of the Portuguese forestry sector is widely acknowledged. This issue raises uncertainties and risks and hinders the drawing up and implementation of policies for the sector and their respective monitoring and assessment. In a globalised world, the quality of information is a vital process for creating value for the development and competitiveness of any sector. Solid investment is needed in the production-provision-use of information. It is thus necessary to invest substantially in the production-availability-use of such information. [Expected date: 2020-2030]

6.8.3. Implement a permanent system for the National Forestry Inventory

The forestry inventory is one of the main sources of information to monitor GHG sequestration and emissions but it also serves as base information for informed forestry policies. It is thus necessary to migrate to a permanent system that allows frequent updates as the current frequency of 10 years does not allow accurate monitoring. [Expected date: 2020-2030]

6.8.4. Implement a system to update land use and monitor changes in land use

A cartographic system that makes it possible to monitor the evolution of land use and identify the main dynamics driving changes in land use is a vital tool for the proper monitoring and calculation of sequestration and emissions. It also provides an information base for informed spatial planning policies and targeted and effective supervision. [Expected date: 2020-2030]

6.8.5. Improve information on the structure and ownership of property

The implementation of agricultural and forestry policies, including incentive and penalty systems requires information on owners and the size of land parcels and as such it is vital to create and improve such information, particularly in areas of the country where there is either no information or it is significantly out of date. The simplified cadastral record will be extended to all of national territory and the updating and vectorization of the geometric registration should be promoted. There will also be a rapid updating of the information in the building registration whenever changes in the ownership or size of the building take place. [Expected date: 2020-2030]

6.8.6. Develop agricultural and forestry innovation and research by improving the capacities of Centres for Competences for the main agricultural and forestry chains

Reinforce the horizontal and vertical integration of chains and sub-chains, promoting coordination between industries, research and production. The process of producing and funding research, development and trials will increase the capacity of forestry actors to influence the topics being researched and to thus respond more effectively to their needs. It is therefore important to continue to develop lines of R&D&I aimed at improving the management and use of forest populations (namely through genetic improvement, silviculture techniques/models, experimenting with new species, biotic and abiotic agents, invasive species), above all in a context of adapting to climate change, as well as those that could lead to the innovation and diversification of uses of woody and non-woody products, by focusing on advanced technologies, new production technologies for wood products, cork, pulp and paper, and on highly efficient processes. These lines will be supported by research programmes, experimental development, extension and innovation, which use and orient the various instruments available at a national and Community level. Good examples include Operational Groups and Collaborative Laboratories. [Expected date: 2020-2030]

6.8.7. Stimulate research and innovation in the area of energy efficiency in the agricultural and forestry sectors.

Promote R&I projects that make it possible to monitor the effects of agricultural and forestry best practices, using digital technologies (remote sensing, satellites, sensors, models, software). [Expected date: 2020-2030]

CONTRIBUTION TO THE DIMENSIONS OF NECP

Decarbonisation; Energy Efficiency; R&I&C

MAIN INSTRUMENTS

RNC2050; ENF; future PEPAC; PNPOT

SOURCES OF FUNDING

FCT; EAFRD; ERDF; Horizonte Europa

ENTITY RESPONSIBLE

MCTES; MA; MAAC; GRA

ACTION STRATEGY

7.5. PROMOTE R&D PROJECTS SUPPORTING A LOW-CARBON, MORE INNOVATIVE AND COMPETITIVE INDUSTRY

DESCRIPTION

Support the development of research and innovation for industry and manufacturing, with a view to developing and adopting advanced materials and technological processes.

SECTOR(S)

Energy; Industry

ACTION MEASURES

To promote R&D&I projects supporting the transition to low-carbon, more innovative and competitive industry, the following action measures are planned:

7.5.1. Promote liaison with Themed Research and Innovation Agendas by the Science and Technology Foundation (FCT)

FCT Agendas seek to mobilise experts from R&D institutions, companies and public entities to identify challenges and opportunities in the national scientific and technological system, from a medium and long-term perspective, contributing to the development of R&I which provides solutions to problems or needs in different sectors of society. Of note in the support of R&I projects which contribute to the decarbonisation of the industrial sector is the Industry and Manufacturing Agenda, which includes the following topics: Advanced materials; Advanced technological processes; Efficient management of resources and processes; Robotics and smart manufacturing systems; Development of collaborative networks and industrial production centred on human beings. This liaison includes Collaborative Laboratories as their aim is to implement research and innovation agendas. [Expected date: 2020-2030]

CONTRIBUTION TO THE DIMENSIONS OF NECP

Decarbonisation; Energy Efficiency; R&I&C

MAIN INSTRUMENTS RNC2050; Agendas FCT
SOURCES OF FUNDING n.s.
ENTITY RESPONSIBLE MCTES; GRA

ii. Cooperation with other Member States in this area, including information on how the SET Plan objectives and policies are being translated to a national context

The European strategy with regard to Research and Development and Innovation for energy, including the European Strategic Energy Technology Plan (SET-Plan)[27], the Horizon Europe[28] (current draft programme which will replace *Horizon* 2020) and the Investment Plan for Europe: Juncker Plan[29], include R&D&I objectives in energy for the 2020-2030 horizon. Participation and cooperation in the SET Plan has proven to be beneficial with respect to joint efforts to achieve common goals to increase the use of new technologies while also creating joint challenges in relation to disruptive actions. Portugal has participated in several implementation groups and activities and considers collaboration in specialist groups for carrying out coordinated action and other forms of collaboration to develop guided projects to be important. The aim is to comply with ambitious targets for the 2030 horizon.

iii. Financing measures in this area at national level, including Union support and the use of Union funds

See 5.3(iii).

[27] https://ec.europa.eu/energy/en/topics/technology-and-innovation/strategic-energy-technology-plan#

[28] https://ec.europa.eu/info/designing-next-research-and-innovation-framework-programme/what-shapes-next-framework-programme_en

[29] https://ec.europa.eu/commission/priorities/jobs-growth-and-investment/investment-plan-europe-juncker-plan_pt

4. CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES

The strategic objectives of NECP seek to attain a reduction in national GHG emissions so as to achieve carbon neutrality by 2050, promoting energy transition through significant focus on renewable energies and energy efficiency, as well as through the mainstreaming of mitigation aims in sector policies.

The scenarios analysed and modelling confirmed the existence of cost-effective trajectories and allowed guidelines and action lines to be determined for sector policies which contribute to the objectives for GHG emission reduction, renewable energies and energy efficiency set out in this plan.

When drawing up NECP, two distinct simulation models of the national energy system were used, more specifically, the TIMES_PT optimisation model (used for Carbon Neutral Roadmap (RNC) 2050 work) and the Janus simulation model based on LEAP (Long Range Energy Alternatives Planning System) software.

For the integration of other sectors, other specific external and complementary models were developed (also developed under RCN2050), more specifically, for the agriculture waste sector (non-energy component), and for land use, land-use change and forestry (LULUCF).

It was therefore necessary to coordinate and standardise the input parameters to be used in the abovementioned models. The results obtained were also subject to the necessary matching.

The abovementioned models allowed projections to be studied and developed for the different parameters reported in this plan, i.e., GHG emissions and removals, renewable energy in gross final energy consumption, primary and final energy consumption in the economy and the evolution of the energy mix and main associated technologies,

It should be noted that, although the aims of both modelling exercises which fed NECP are different – the RCN2050 base modelling exercise sought to identify cost-effective trajectories from 2020 to 2050, and Janus modelling sought to establish finer-tuned modelling of the national energy system for the 2040 horizon with a view to achieving the targets defined for 2030. The results are coordinated and are considered generally coherent and consistent, providing an important contribution to the establishing of clear guidelines for the 2050 horizon.

4.1. Projected evolution of main exogenous factors influencing energy system and GHG emission developments

i. Macroeconomic forecasts (GDP and population growth)

Although the narratives and the respective macroeconomic and demographic variables developed originate from two distinct exercises (Janus and RCN2050 modelling), they allow evolution scenarios to be established and described for the different sectors of activity - energy and industry, transport and mobility, agriculture, forestry and other land uses, and waste and wastewater - more specifically, in the estimate and characterisation of demand for mobility energy services, in economic production models and in the organisation of consumption, among others.

Table 18- Main assumptions used in national energy system modelling (GDP and Population)

	2020	2025	2030
GDP (variation rate) [JANUS Model | Times_PT Model]	1.7% | 2.0%	1.3% | 1.6%	1.0% | 1.5%
Population (millions) [JANUS Model | Times_PT Model]	10.18 | 10.25	10.00 | 10.14	9.84 | 10.00

ii. Sectoral changes liable to impact on the energy system and GHG emissions

With respect to sector changes liable to impact on the energy system and GHG emissions for the 2030 horizon, it is considered that the GVA structure will remain largely unchanged in relation to the 2016 base. However, there will be a slight increase in the area of Services to the detriment of a slight reduction in the component for Construction and Agriculture

It is expected that economic growth will be driven by traditional industries, against a background of much greater integration by Portugal into international circuits, in line with that seen in recent years, and by a number of new services integrated into the global economy. However, as already mentioned, economic growth does not lead to significant changes in the production structure for goods. The logistics associated to the production, distribution and consumption of goods will essentially retain its current characteristics.

Table 19- Main assumptions used in national energy system modelling (GVA)

	2020	2025	2030
GVA Construction and Public Works (% of total GVA)	3.7%.	3.8%.	3.7%.
GVA Agriculture and Fisheries (% of total GVA)	1.9%.	1.9%.	1.9%.
GVA Extraction Industry (% of total GVA)	0.3%.	0.3%.	0.3%.
GVA Manufacturing Industry (% of total GVA)	14.2%.	14.0%.	13.9%.
GVA Services (% of total GVA)	68.8%.	69.6%.	70.1%.

iii. Global energy trends, international fossil fuel prices, EU ETS carbon price

With respect to the cost of CO2 emissions licences, a different approach was considered under work for RCN2050 in relation to the TIMES_PT model:

- existing policies scenario, a constant carbon price equal to EUR 20/tonne was considered;
- planned policies scenario (or neutrality scenario), an initial carbon price was not imposed. This results in a 'shadow price' for the model as an emissions restriction in 2050 is imposed with a view to complying with the carbon neutral objective.

Table 20 - Main assumptions used in national energy system modelling (Prices)

	2020	2025	2030
$CO_{2\ licences}$(€/ton)[30]	15.0	22.5	33.5
Oil (€/GJ)[29]	11.6	13.2	14.5
Coal (€/GJ)[29]	7.5	8.2	8.8
Natural Gas (€/GJ)[29]	2.2	2.7	3.2

iv. Technology cost developments

Also with respect to the evolution of technological costs, both modelling exercises took into account a vast series of technologies and the respective investment costs and variable and fixed costs based on the best information available, both nationally and internationally. Attached are the costs considered in both models for the main technologies as well as the respective sources of information.

4.2. Decarbonisation dimension

4.2.1. GHG emissions and removals

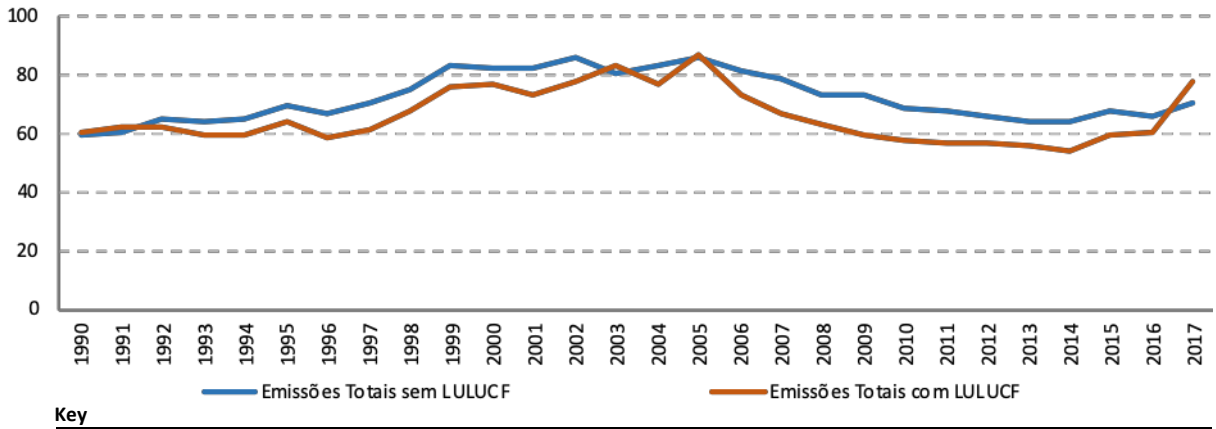
4.2.1.1. Total greenhouse gas emissions in Portugal

After the rapid growth seen in GHG emissions in the 90s, Portugal reached its peak emission point in 2005, after which there was a significant and sustained fall. Since then, a trajectory of decarbonisation of the national economy has been consolidated. In fact, in 2005 an increase in emissions of around 44% was seen when compared to 1990 levels. According to the most recent updating of the National Emissions Inventory 2019 (for 2017), GHG emissions, excluding emissions from land use change and forestry (LULUCF), are estimated at approximately 70.7 Mt CO 2eq, representing an increase of 19.5% over figures for 1990 and growth of 7.0% over 2016.

For the LULUCF sector, total emissions in 2017 are estimated at 78.0 Mt CO_{2eq}, corresponding to an increase of 29.2% in relation to 1990 and a rise of 28.5% over 2016. This steep growth relates to the tragic forest fires which occurred in 2017, a situation influenced by a particularly dry year, the high temperatures seen outside the normal summer period (the largest forest fires occurred in June and October), and to unusually strong winds, such as hurricane Ophelia which swept the Iberian Peninsula coast in October 2017.

[30] Source: European Commission, *EU Reference Scenario 2016*

Evolution in sector GHG emissions 1990-2017 (Mt CO_{2e}) [Source: APA]



Key

PT	EN
Emissões Totais sem LULUCF	**Total emissions without LULUCF**
Emissões Totais com LULUCF	**Total emissions with LULUCF**

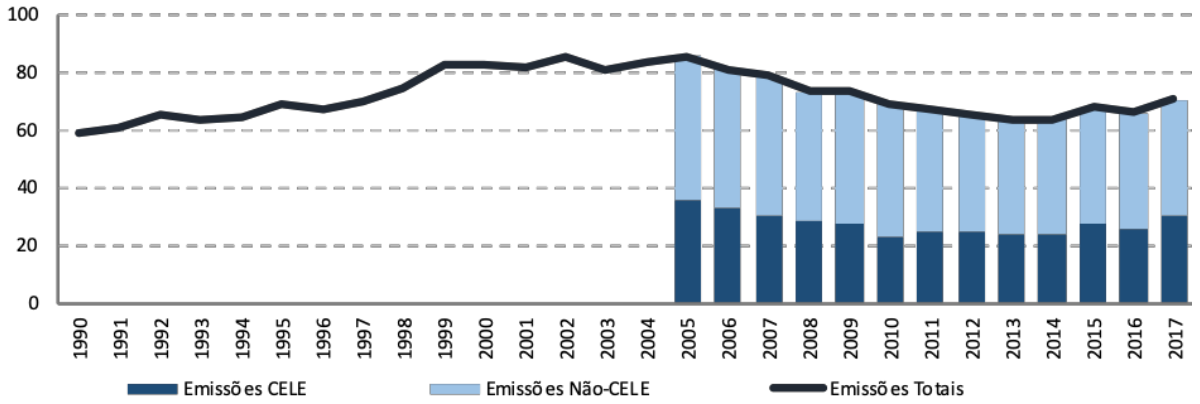
With regard to the first Kyoto commitment period and as a result of sharing responsibilities on a Community level, it was established that from 2008 to 2012 Portugal could increase its emissions by 27% in relation to 1990. Portugal complied with this objective mainly by limiting GHG emissions in all sectors of the economy and by capturing carbon in land use, land-use change and forestry (LULUCF). The trajectory since 2005 has thus allowed compliance with the Kyoto Protocol.

For the 2013-2020 period, the EU set a Community goal of a reduction of a minimum of 20% in GHG emissions in relation to 1990. In this regard, the sectors covered by EU ELT are expected to reduce emissions by 21% in relation to 2005 and remaining sectors by 10% in relation to 2005. Targets were also set to achieve 20% of energy from renewable sources in final consumption and an increase in energy efficiency (EE) of 20%.

With regard to effort sharing, Portugal committed to limiting growth in GHG emissions to +1% up to 2020 (in relation to 2005) for sectors not covered by ELT. Annual limits were also set for non-ELT emissions in this period. Under the 2020 energy-climate package, Portugal also committed to a target of 31% of energy from renewable sources in gross final energy consumption (RES), 10% of which was in transport, an EE general objective of 25% and a specific EE objective for Public Administration of 30%. Ii is important to note that these emission reduction targets are integrated into joint compliance by the EU, its Member States and Iceland in the second Kyoto Protocol commitment period.

The following figure shows the evolution of national emissions from 1990 to 2017 and identifies, as of 2005, the contribution from EU ELT and non-ELT sectors.

Figure 25- in national GHG emissions (Mt CO 2eq) by ELT and non-ELT sector: [Source: APA]



Key

PT	EN
Emissões CELE	ETS emissions
Emissões Não-CELE	Non-ETS emissions
Emissões Totais	Total emissions

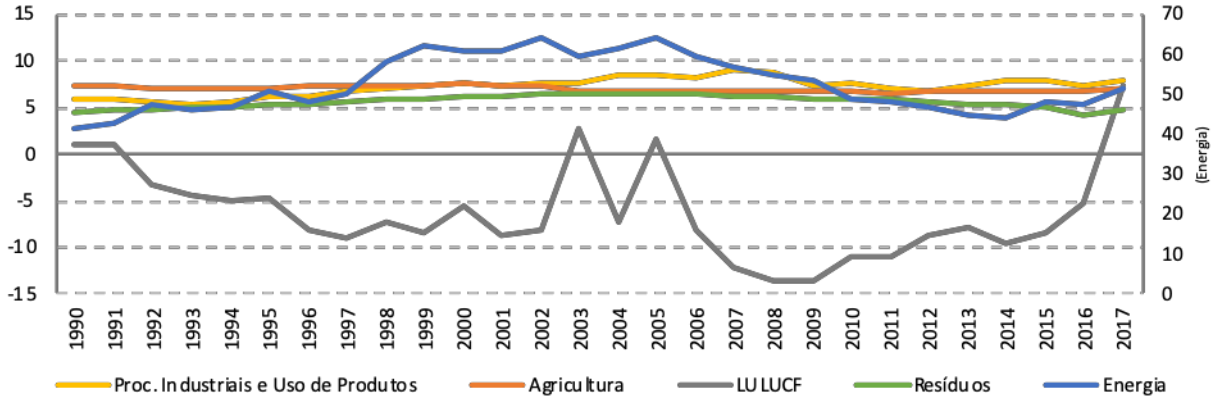
An analysis of GHG emissions per GDP unit shows that a process was started in 2005 to decouple GDP from emissions, as a result of the decarbonisation of the economy, in other words, an economy with less carbon emitted per unit of wealth produced. This trend started before the current economic crisis.

Several factors are driving this trend including the growth in the use of less polluting energy sources such as natural gas, the construction of combined cycle power plants and more efficient co-generation units.

Other reasons include the significant growth in renewable energy (mainly wind and hydro), and the implementation of energy efficiency measures. The improvement in efficiency in transport (through fleet renewal) and in housing (through building certification) may also explain such trends.

Public policies on climate change are today an integral part of a series of sector policies in Portugal. In areas such as energy and industry covered by ELT, the 'carbon dimension' today forms part of the strategic and economic considerations of companies. In agriculture and forestry, there is also growth in awareness of the important contribution the sector can make with regard to mitigating GHG emissions. In areas with specific challenges such as the transport sector, important steps have been taken to decarbonise vehicle fleets. Moreover, an electric mobility network has been created and support schemes have been introduced for electric vehicles with the aim of reinforcing incentives for the use of such vehicles.

Figure 26 - Evolution in sector emissions 1990-2017 (Mt CO_{2eq}) [Source: APA]

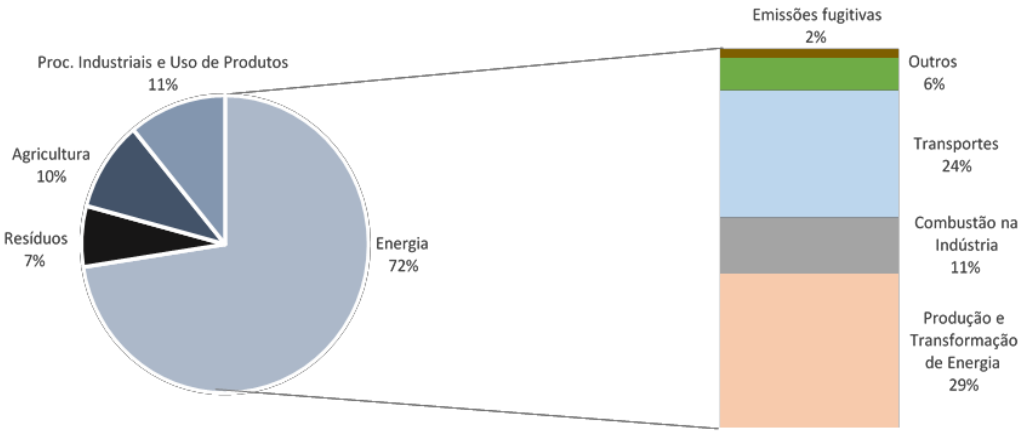


Key

PT	EN
Proc. Industriais e Uso de Produtos	Industrial processes and product use
Agricultura	Agriculture
LULUCF	LULUCF
Resíduos	Waste
Energia	Energy

The energy sector, which includes transport, represented 72% of national emissions in 2017, with growth of 8.7% over figures for 2016. In this sector, energy production and transport contribute most, representing around 29% and 24%, respectively, of all national emissions.

Figure 27 - Sector emissions in CO_{2eq} in 2017 [Source: APA]



Key

PT	EN
Proc. Industriais e Uso de Produtos	**Industrial processes and product use**
Agricultura	**Agriculture**
Resíduos	**Waste**
Energia	**Energy**
Outros	**Other**
Transportes	**Transport**
Combustão na Indústria	**Combustion in Industry**
Produção e Transformação de Energia	**Production and Transformation of Energy**

Combustion in Industry, responsible for around 11% of national emissions, saw growth of 1.2% in 2017 over 2016. Fugitive emissions, representing 2% of all emissions, saw growth of 6.9% over 2016.

The sectors of industrial processes and product use (IPPU), agriculture and waste have an approximate weighting, representing 11.0%, 9.8% and 6.6%, respectively. The IPPU and Agricultural sectors show positive variations if 6.5% and 1.7%, respectively, over 2016, while Waste has a negative trend of 1.3% with respect to 2016.

With respect to agriculture, growth in emissions from 2016 to 2017 can be mostly explained by the increase of cattle for fattening (+38 330 animals), sheep (+63 700) and poultry (+1 652 740), as well as by the greater productivity of rice growing (+340 kg/ha).

The growth in emissions from industrial processes essentially relates to the increase in clinker and nitric acid production in 2017 when compared to 2016. The use of steel scrap (less pollutant) at steel foundries, instead of pig iron, also contributed to the reduction of emissions in this sector in 2017. The increase in emissions from industrial processes with respect to 1990 (32%) is due to the growth in emissions of fluorinated gases, particularly in the sub-sectors of stationary air conditioning and commercial refrigeration.

The reduction in emissions in the waste sector in recent years is due to the use of biogas in wastewater treatment systems, as well as the focus on Mechanical and Biological Treatments which seek to reduce urban waste (RUB) in landfills and the increase in recovered recyclable waste.

4.2.1.2. Projections of sectorial developments with existing national and EU policies and measures at least until 2040 (including for the year 2030)

As part of work under RCN2050, projections were made for the activity trajectories and the respective GHG emissions of the corresponding sectors of activity, the energy system (including the production, transmission and consumption of energy sectors), agriculture, forestry and other land uses and waste and wastewater. This exercise further included an equally detailed assessment for 2030 and 2040 which allowed new emissions trajectories to be delineated compatible with the national objective to achieve carbon neutrality by 2050.

A new development in relation to similar exercises conducted in the past, is the fact that some of the expectable

climate changes for the horizon 2050 were included in the modelling.

These changes included alterations in the efficiency of technologies, demand for services and the availability of resources (such as a reduction in hydro availability or an increase in cooling requirements).

Results from these projections have allowed potential national emission reduction to be reanalysed, confirming the technical and economic viability of pursuing a low-carbon trajectory for 2020/2030, on the road to carbon neutrality in 2050.

A sector analysis of emissions trajectories confirms that all sectors have significant potential to reduce GHG emissions, although the speeds of reduction may differ.

Analysis of the behaviour of the different sectors in the conditions established for the existing policies scenario, as well as for the additional policies (or neutrality scenarios) helps identify key factors, trends and behaviours for the same timeframe considered.

The methodologies used to estimate GHG emissions is that set out in the *National Inventory Report* (NIR). A specific projection methodology for the respective activity variables was adopted for each of the sectors of activity. However, it was based on the same socio-economic framework to ensure consistency in the projections obtained. It should be further noted that, for the purposes of the projections presented in the existing policies scenario, the policies and measures instruments approved and published up to 31 December 2017 were taken into account, as were a number of commitments undertaken by Portugal, such as the termination of power production from coal. Shown below is a results summary of modelling carried out on GHG emissions per sector for the 2030 and 2040 horizons, in a scenario of existing policies.

Table 21- Projection of GHG emissions per sector – Existing policies scenario (kt CO2eq)

	2005	**2020**	**2030**	**2040**
1. Hydro	63 958	45 035	27 260	21 136
Production of electricity	23 057	12 942	1 616	662
Refining	2 466	2 220	2 129	1 802
Fugitive emissions	669	1 202	1 157	1 090
Industry	10 565	7 646	6 222	5 791
Transport	19 821	16 272	11 699	7 883
Services	3 164	1 178	1 203	860
Residential	2 695	2 427	2 079	1 963
Agriculture, forestry and fisheries	1 447	1 163	1 158	1 090
2. Industrial Processes and Use of Products	8 419	7 043	5 157	4 416
Industrial processes	7 339	4 817	4 289	3 900
F-gases	1 080	2 226	868	516
3. Agriculture	6 770	6 791	6 566	6 648
4. LULUCF	1 520	-3 778	-8 082	-9 310
Forest land	-2 224	-8 673	-12 697	-14 029
Agricultural land	1 361	802	623	607
Pasture	1 701	128	416	504
Other land	647	3 964	3 576	3 608
5. Waste and Wastewater	6 463	4 405	3 317	2 358
Total without LULUCF	**85 610**	**63 274**	**42 303**	**34 562**
Total with LULUCF	**87130**	**59 496**	**34 221**	**25 252**
Total EU ETS	**36 426**	**25 749.0**	**12 795.2**	**10 301.1**
Total Non-EU ETS	**49 184**	**37 241.5**	**29 309.2**	**24 089.3**

As can be seen, even in an existing policies scenario, a sharp reduction in GHG emissions is expected in coming decades, and cost-effective potential exists for Portugal to reduce total emissions by 2030 of around 51% in relation to 2005. This figure will rise to 60% by 2040 (without LULUCF).

In 2030, this reduction will be largely the result of the closure of coal-fired power plants and focus on the role of renewable energies in the national energy mix, particularly solar. By 2030, the electricity production sector has the potential to reduce GHG emissions by around 93% with respect to 2005 (and around a 97% reduction by 2040).

The transport and mobility sector is also expected to see far-reaching changes with much increased use of electric vehicles and potential emissions reduction of around 41% by 2030 with respect to 2005 and around 60% by 2040.

The services and wastes sectors also have solid potential to reduce GHG emissions, contributing with 62% and 49%, respectively by 2030 (and 73% and 64%, respectively, by 2040). This will be due to increased energy efficiency and compliance with the Landfill Directive restricting deposits to just 10% by 2035. In relation to the waste sector, the existing policies scenario already assumes compliance with the target set out in the Landfill Directive, and as such, the projection for this sector are identical in both in the existing policies as well as in the additional policies scenarios.

In the same timeframe, the residential, industrial and agriculture sectors have lower decarbonisation potential. Even so, the residential sector could contribute with a reduction of 23% by 2030 (around 27% by 2040) and the industrial sector with 42% (around 47% in 2040). For the agricultural sector, figures show a reduction of 3% by 2030. Taking into account the effect of agricultural land and pasture, reductions could reach 22% by this time.

With regard to F-gases, the relevance of which terms of emissions has increased in recent years, reductions are expected of around 20% by 2030 and 52% by 2040. As was the case in the waste sector, compliance with the targets set out in the Kigali Amendment are also assumed in the F-gases sector, and as such, the projections for this sector are identical in both in the existing policies as well as in the additional policies scenarios.

However, additional policy measures need to be considered for the majority of sectors, so as to achieve a more ambitious low-carbon trajectory, allowing carbon neutrality to be reached by 2050.

4.2.2. Energy from renewable sources

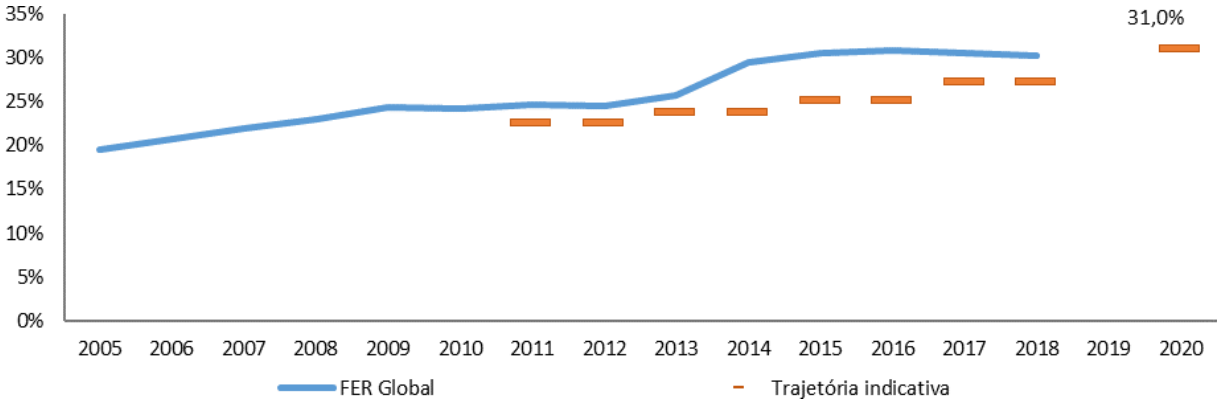
ii. Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors

Further to Directive 2009/28/EC of the European Parliament and of the Council of 23 April introducing the requirement for EU members to submit a plan to promote the use of energy from renewable sources, Portugal prepared and submitted its first National Action Plan for Renewable Energy (PNAER) in 2010. The commitment in this plan was to achieve the objectives set in the Directive and to reach the overall target of 31.0% of renewable energy in gross final energy consumption, the fifth most ambitious target in the EU-28, and 10.0% of renewable energy sources in final energy consumption in transport.

Portugal has seen good progress in compliance with objectives for 2020. In 2018, the incorporation of renewable energy sources into gross final energy consumption is expected to be around 30.3%.

This is a reduction of 0.3 p.p. with respect to figures for 2017 and 3.0 p.p. above the indicative trajectory, meaning that Portugal has already achieved around 98% of its target for 2020. The following figure shows the evolution in the share of renewable energy sources in gross final energy consumption in 2005 and 2018.

Figure 28 – Evolution in the share of renewable sources in gross final energy consumption in Portugal [Source: DGEG]

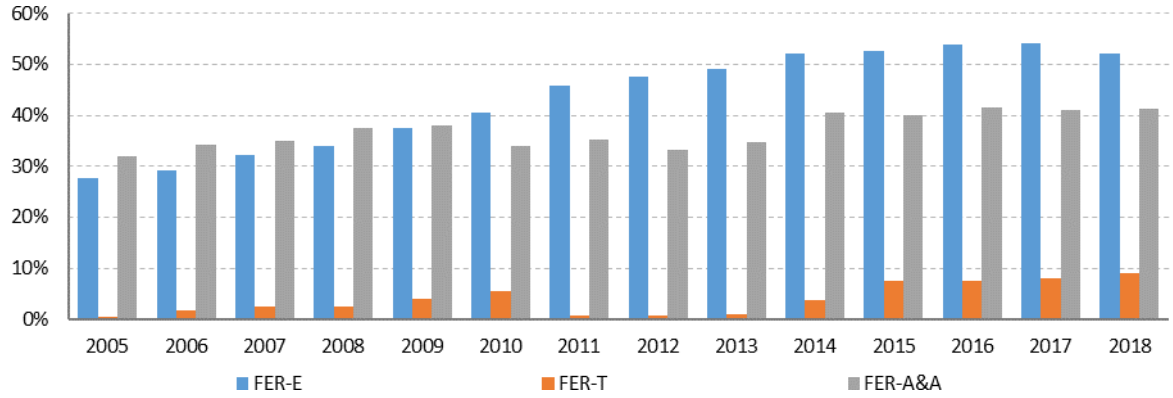


Key

PT	EN
FER Global	RES
Trajetória indicativa	Indicative trajectory

On a sector level, in 2016 the share of renewables in the electricity sector (RES-E) was 52.2% (2.0 p.p. over 2017), in the Heating and Cooling sector (RES-H&C) it was 41.2% (0.2 p.p. over 2017) and in the Transport sector (RES-T) it was 9.0% (1.1 p.p. over 2017). The following figure shows the evolution in the share of renewable energy sources in gross final energy consumption in 2005 and 2017[31].

Figure 29 – Evolution in the share of renewable sources in gross final energy consumption in Portugal per Sector [Source: DGEG]



Key

PT	EN
FER-E	RES-E
FER-T	RES-T
FER-A&A	RES-H&C

iii. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

Table 22 shows projections based on current policies and measures in gross final energy consumption in Portugal.

[31] Data for 2018 per sector not yet established at this stage.

Table 22- Projections based on current policies and measures in gross final energy consumption in Portugal

	2020	2025	2030
RES-H&C	60%	69%.	80%.
RES-E	34%	36%.	38%.
RES-T	10%	13%.	20%.
Overall RES share	31%	38%.	47%.

Shown in the following table are projections based on current policies and measures of the contribution of renewable energies in each sector for final energy consumption.

Table 23- Projections based on current policies and measures of the contribution of renewable energies in each sector for final energy consumption (ktoe)

	2020	2025	2030
Gross final consumption of RES for heating and cooling	1 805	1 824	1 868
Gross final consumption of electricity from RES	3 136	3 404	4 500
Gross final consumption of energy from RES in transport	437	566	900
Gross total RES consumption	5 378	5 794	7 268
Transfer of RES to other Member States	0	0	0
Transfer of RES from other Member States and 3rd countries	0	0	0
Consumption of RES adjusted to objective	5 378	5 794	7 268

A breakdown of the Heating and Cooling sector is presented in the following table.

Table 24- Projections based on current policies and measures of the total effective contribution of (final energy consumption) of each renewable energy technology in Portugal in the Heating and Cooling sector (ktoe)

	2020	2025	2030
Biomass	963	965	953
Heat pumps	101	102	102
Solar thermal heating	91	89	86
Heat from cogeneration	650	655	677
Renewable gases	0	12	50
GRAND TOTAL	**1 805**	**1 824**	**1 868**

A breakdown of the Transport sector is presented in the following table.

Table 25- Projections based on current policies and measures of the total effective contribution (final energy consumption) of each renewable energy technology in the Transport sector (ktoe)

	2020	2025	2030
1st Generation biofuels	393	255	136
Advanced biofuels	-	94	155
Renewable hydrogen	-	9	65
Electricity	44	208	543
GRAND TOTAL	**437**	**566**	**900**

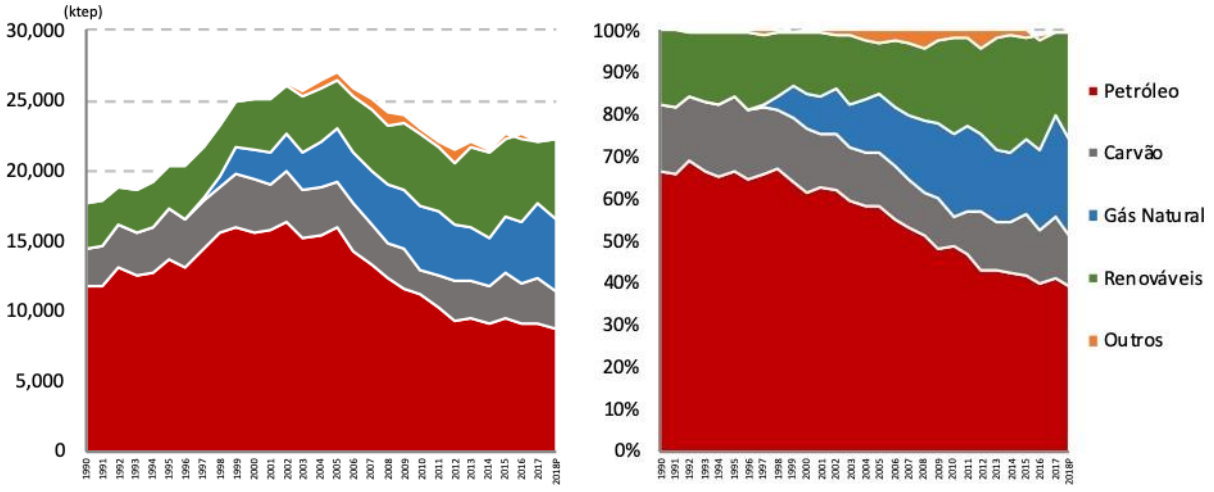
4.3. Dimension Energy efficiency

i. Current primary and final energy consumption in the economy and per sector (including industry, residential, service and transport)

Data for 2018 on Primary Energy Consumption (PEC) show a reduction of 2.8% in relation to consumption in 2017. Consumption of 22 492 ktoe was seen due to greater availability of indigenous resources, particularly hydro and wind, resulting in a reduction of natural gas and coal imports to produce electricity. Analysing the last decade, 2009-2018, PEC recorded an average annual growth rate (aagr) of -0.7%[32].

With regard to the consumption of primary sources of energy, oil is predominant in the energy mix in Portugal. In 2018, it represented 39% of PEC, followed by renewable energy with 26%, natural gas with 22% and coal with 12%. With the introduction of natural gas in 1997 and the increased diversification of renewable energy sources, the weighting of oil in PEC has fallen in recent years, and since 2018 it has represented less than 40% of consumption. The use of coal in Portugal varies, mainly as a result of demand in the electricity production sector, which is influenced by the greater or lesser availability of renewable resources, particularly hydro and wind, given the high weighting that these components currently have. The following figure shows the evolution in total PEC by type of source from 1990 to 2018.

Figure 30 - Evolution in Total Primary Energy Consumption by type of source in Portugal 1990-2018 [Source: DGEG]



Key

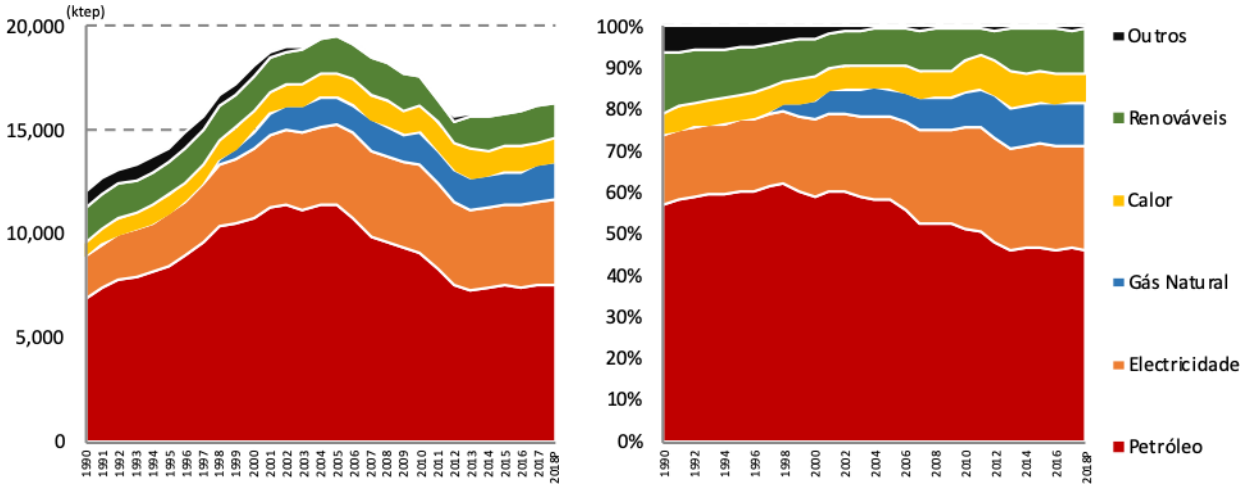
PT	EN
Petróleo	**Oil**
Carvão	**Coal**
Gás Natural	**Natural gas**
Renováveis	**Renewables**
Outros	**Other**

[32] Provisional data for 2018. Data for 2014 to 2018 already include the contribution of heat pumps.

In 2018, Portugal recorded total Final Energy Consumption (FEC) of 16 470 ktoe, an increase of 1.4% over 2017. During the last decade, 2009-2018, FEC recorded aagr of -0.9%. Of note among the factors contributing to the reduction in FEC in recent years is the promotion of energy efficiency with particular focus on the industrial and domestic sectors through the implementation of more efficient solutions and the slowdown in the economy which affected consumption generally across all sectors of the economy[33].

With respect to final energy consumption by type of source, and as already mentioned, oil plays a key role in Portugal's energy mix, in 2018, oil represented 46% of final energy consumption, followed by electricity with 25%, natural gas with 11%, heat with 7%, renewables with 11%, which included the use of firewood and plant waste, Solar Thermal, Biogas and other renewables, and other sources of energy which represented 1%. In recent years, a gradual reduction has been seen in the weighting of oil in final energy consumption, while natural gas and electricity have recorded an increase. The following figure shows the evolution in total FEC by type of source from 1990 to 2018.

Figure 31 - Evolution in Total Final Energy Consumption by type of source in Portugal [Source: DGEG]



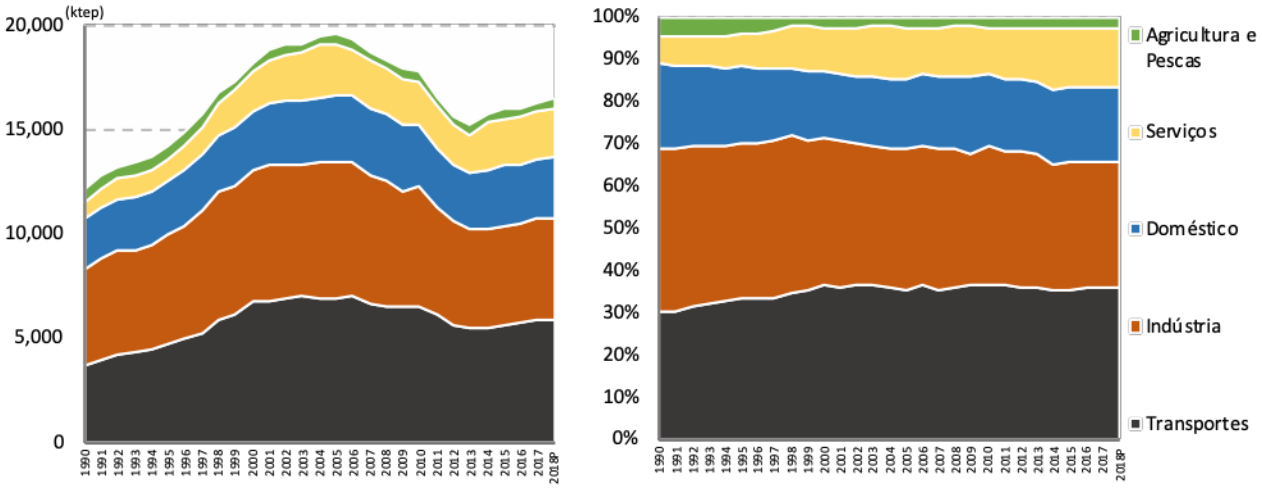
Key

PT	EN
Outros	Other
Renováveis	Renewables
Calor	Heat
Gás Natural	Natural gas
Eletricidade	Electricity
Petróleo	Oil

In terms of the different sectors, it can be seen that Transport uses most energy in Portugal, representing 36% of FEC in 2018. This was followed by Industry (30%), Domestic (18%), Services (14%) and finally Agriculture and Fisheries (3%). The structure of consumption by sector of activity has remained largely unchanged over the last decade, with only slight oscillations being seen from year to year, as the following figure shows[34].

[33] Provisional data for 2018. Data for 2014 to 2018 already include the contribution of heat pumps.
[34] Provisional data for 2018. Data for 2014 to 2018 already include the contribution of heat pumps.

Figure 32 - Evolution in Total Final Energy Consumption by sector of activity in Portugal [Source: DGEG]

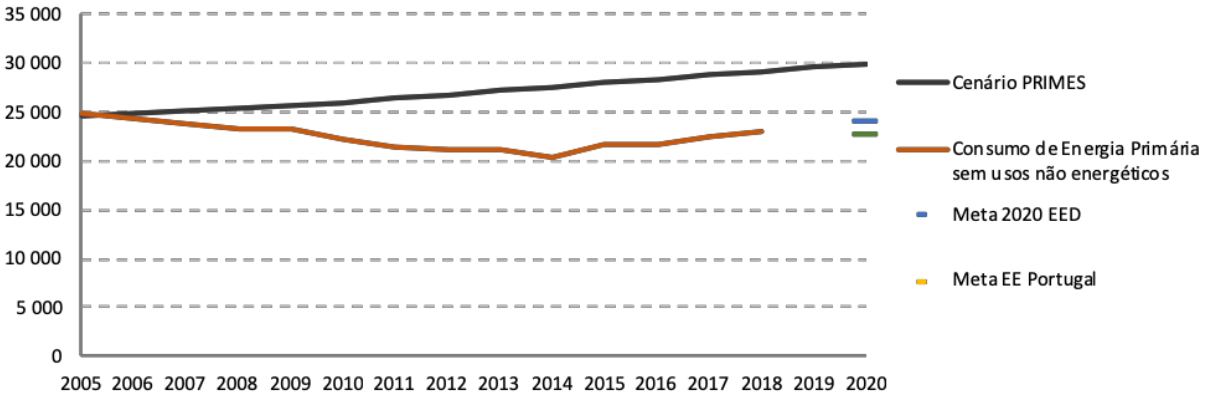


Key

PT	EN
Agricultura e Pescas	**Agriculture and Fisheries**
Serviços	**Services**
Doméstico	**Domestic**
Indústria	**Industry**
Transportes	**Transport**

For the 2020 horizon, and with respect to Directive 2012/27/EU of the European Parliament and of the Council of 25 October on Energy Efficiency, the objective was redefined for a maximum limit on primary energy consumption by 2020 (based on projections of the PRIMES model for the European Commission carried out in 2007) equivalent to a reduction of 20% (24.0 Mtoe, excluding non-energy uses). Portugal later adopted a more ambitious target of 25% reduction (22.5 Mtoe, excluding non-energy uses). Evolution in primary energy consumption excluding non-energy uses, including international aviation uses (reference to calculate compliance with the Energy Efficiency target in 2020) shows that in 2018, the value is in line with Portugal's reference value and as such, the country is on the way to complying with the 2020 target.

Figure 33 - Evolution in the Portuguese target for Energy Efficiency for 2020 (Ktoe) [Fonte: DGEG]



Key

PT	EN
Cenário PRIMES	**PRIMES scenario**
Consumo de Energia Primária sem usos não energéticos	**Primary Energy Consumption without non-energy uses**
Meta 2020 EED	**2020 EED Target**
Meta EE Portugal	**Portugal EE Target**

The Energy Intensity of the economy in primary energy in 2018 recorded a value of 122 toe/M€'2011, where a reduction of 5% was seen with respect to 2017 and a reduction of 22% with respect to 2005, the year in which energy intensity reached the highest the value of recent years (156 toe/M€'2011). As of 2008, a clear decoupling of PEC from GDP can be clearly seen.

Figure 34 – Evolution in the energy intensity of the economy in primary energy In Portugal (toe/M€'2011) [Source: DGEG]

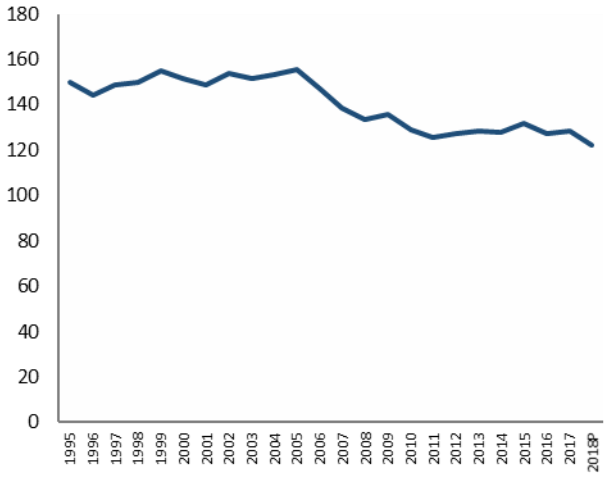
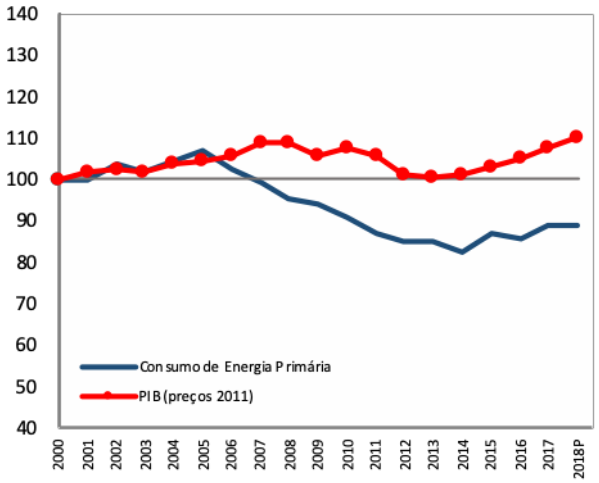


Figure 35 – Figure 37 - Evolution of FEC and GDP in Portugal (2000 = 100) [Source: DGEG, INE]



Key

PT	EN
Consumo de Energia Primária	Primary Energy Consumption
PIB (preços 2011)	GDP (prices 2011)

The Energy Intensity of the economy in final energy, recorded a value of 89 toe/M € in 2018, a reduction of 1% with respect to 2017, and a reduction of 21% with respect to 2005, the year in which energy intensity reached the highest the value of recent years (112 toe/M€'2011). Similarly, a decoupling between FEC and GDP can be seen as of 2008.

Figure 36 – Evolution in the energy intensity of the economy in final energy in Portugal (toe/M€' 2011) [Source: DGEG]

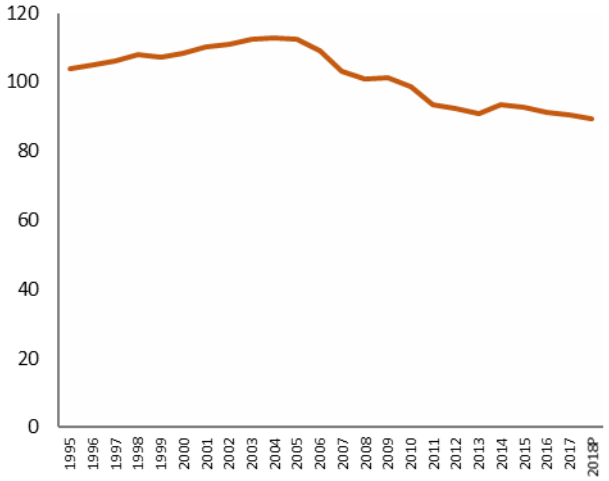
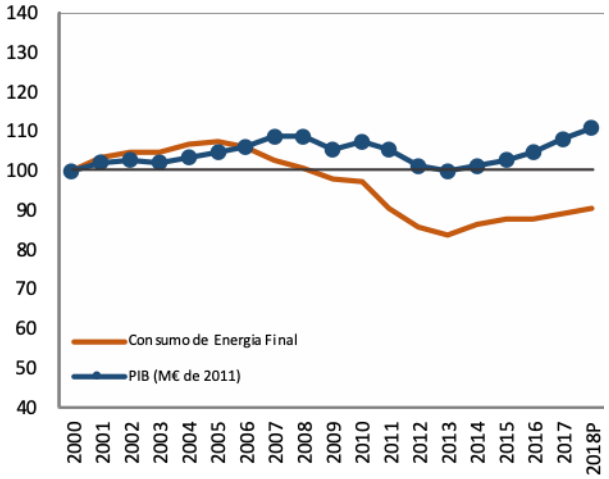


Figure 37 – Figure 37 - Evolution of FEC and GDP in Portugal (2000 = 100) [Source: DGEG/INE]



Key

PT	EN
Consumo de Energia Final	Final Energy Consumption
PIB (M€ de 2011)	GDP (M€ 2011)

ii. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling

In accordance with Article 14 of Directive 2012/27/EU of 25 October 2012 on energy efficiency, in December 2016, Portugal conducted an assessment of the potential for the application of high-efficiency cogeneration and efficient district heating and cooling, taking into account the premises set out in Annex VIII of this Regulation for a 10-year timeline after the reference year used, which in Portugal's case is 2014.

This study analysed the main energy sources of each sector with the aim of summarising energy requirements, more specifically with regard to demand for heating and cooling and thus obtain a detailed assessment.

Based on this assessment, the charts indicated in Annex VIII of the Directive were created and a critical analysis of these charts was carried out.

Based on a brief description of the current cogeneration situation in Portugal, the technical potential of cogeneration and efficient heating and cooling networks was analysed. The economic potential and an estimate of evolution in this potential were also analysed.

With the publication of the new Energy Efficiency Directive, Directive EU 2018/2002, work on a similar study to that mentioned above has already started. Work was based on the new provisions for energy efficiency, particularly those referring to high-efficiency cogeneration.

ii.1 Energy requirements - demand for heating and cooling

Demand for heating and cooling was determined based on average values of the needs of each sector, thus defining the heat replaceable by high-efficiency cogeneration.

Agriculture and Fisheries:

Energy consumption for this sector is highly diverse. Consumption of diesel is predominantly for agricultural and forestry machinery and also for fisheries. Electricity plays an important role in the processing and preservation of products.

The preferential areas in agricultural production with greater activity are those where the climate as well as the soils are more propitious and fishing activities are restricted to the coastal area.

Industry:

Industry is not considered dependent on climate variations from region to region as most energy requirements are in the manufacturing process and production itself, therefore it is important to consider the energy consumption patterns in the different sub-sectors.

Unlike agriculture and fisheries, heating in industry has greater weighting than cooling. Most production processes need or produce heat, so a large amount of consumption used in producing this heat could be replaced by cogeneration.

Services Sector:

The Services Sector is fairly diverse and ranges from small commercial units to large shopping centres and hospitals, as well as office buildings, schools, sports facilities, hotels, etc. Services vary in size (area, number of people) and in hours of use, so there is a broad spectrum of variation making it difficult to assess thermal needs per type of sub-sector. Consumption for climate control requirements is also highly influenced by climate area and by the activity the building is intended for.

Energy consumption by the sector is very varied and is normally associated with large towns and cities where there is a greater concentration of companies and services. In general, energy demand for cooling is predominant in this sector and heating needs are quite low.

Residential Sector:

Consumption in the residential sector in Portugal is very low when compared to consumption in other European countries, particularly with regard to consumption for heating and even for cooling. This is due to Portugal's mild climate. However, the situation does vary from region to region.

In terms of final consumption, kitchens contribute the largest parcel with around 39% of final consumption, followed by water heating with 23%. However, in the former electricity is the main source,

while water heating is principally from LPG. Lighting accounts for only a small amount of energy needs with only 4.5% of consumption and energy use for cooling is minimal.

The short winters and extended warm seasons together with financial limitations also explain why there are so few houses with central heating. There is even a significant number of homes for which there are no records of any type of heating, in any of the regions. A further important aspect refers to the energy source used in heating systems, where electricity is predominant, particularly in the Lisbon region. With the exception of new high-density housing estates, or proximity to services buildings which already have cogeneration, cases which are expected to have limited expression, there is insufficient demand to justify district heating networks for the residential sector.

It should be noted that there has been a sharp drop in consumption in the residential sector, at an average rate of -4.4% per year since 2009. This is due to an increase in energy efficiency brought about by multiple measures implemented and the improvement in equipment as well as higher energy prices. Improved efficiency is apparently greater in ambient heating with a reduction of 31.7% from 2000 to 2013, and a drop of around 28.8% in kitchen energy and Domestic Hot Water (DHW).

However, the economic recovery, growth in housing requirements and the growth in the number of electrical appliances will drive new demand for energy in buildings.

Technical potential for high-efficiency cogeneration

Cogeneration units in operation in 2014 provided for 1 759 MW of installed electrical power, and 4 631 MW of thermal power, having produced a total of 7 484 GWh of electrical power and 19 249 GWh of thermal energy, thus corresponding to a T/E ratio of 2.57. Total yield is 79% and the average number 4 349 hours of power use. Applying the assumptions and associated reference values to the Directive, taking into account the fuels used by each unit and system losses with respect to location voltage, results in total savings estimated at 30 740 TJ (0,73 Mtoe) of primary energy, corresponding to savings of 33.5%.

The following table shows a technical potential of cogeneration for the production of heat (estimated based on maximum replacement percentages and values for replacement heat consumption) of approximately 2.7 Mtoe of potentially usable heat. The same table also shows estimates of cooling consumption requirements for Industry, the Residential Sector and Services, resulting in 0.5 Mtoe of final energy which would correspond to between 1.1 Mtoe and 2.2 Mtoe of additional heat to feed absorption chillers, thus resulting in 3.8 to 4.9 Mtoe of thermal production from cogeneration.

Assuming an average T/E ratio and an average number of hours of use seen at existing cogeneration units in 2014 (2.57 and 4 349 hours, respectively), the electrical power generated and the installed electrical power would correspond to 12 TWh (2.8 GW) just to satisfy heating requirements and 17.3 TWh to 22 TWh (4.0 GW to 5.1 GW) to meet cooling requirements.

However, achieving all of this potential is unrealistic as it does not take into account the operating schemes of cogeneration units, downtime for maintenance, or basic aspects such as minimum operating power. Therefore, the technical potential will be definitely higher than achievable potential.

Table 26- Calculation of heating and cooling power to be supplied by cogeneration [Source: DGEG, Study on High-efficiency Cogeneration in Portugal, 2016]

Sector	General Total	Total replaceable thermal energy	Replacement potential		Cooling consumption (estimate)
	toe	toe	(%)	toe	toe
Final consumption	**15 166 780**	**3 930 121**	**66.21%**	**2 602 023**	**520 053**
Agriculture and Fisheries	**427 875**	15 124			
Agriculture	*338 172*	11 485	100.00%.	11 485	
Fisheries	*89 703*	3 639			
Quarrying industries	**111 645**	28 503			
Manufacturing industries	**4 361 269**	2 811 963			174 451
Foodstuffs, Beverages and Tobacco	*445 139*	234 813	100.00%.	234 813	
Textiles	*254 984*	161 532	81.00%.	130 841	
Paper and Paper Items	*1 366 239*	1 062 925	100.00%	1 062 925	
Chemicals and Plastics	*432 372*	227 840	100.00%.	227 840	
Ceramics	*268 395*	217 841	7.00%.	15 249	
Glass and Glass Products	*242 745*	197 882	7.00%.	13 852	
Cement and Lime	*645 081*	493 032	10.00%.	49 303	
Metal Working	*46 394*	25 222	19.00%.	4 792	
Steel Industries	*165 875*	54 540	30.00%.	16 362	
Clothing, Footwear and Leather	*45 625*	18 499	81.00%.	14 984	
Wood and Wood-based Products:	*99 951*	21 818	81.00%.	17 673	
Rubber	*35 171*	14 275	100.00%.	14 275	
Metal-electrical-Mechanical	*243 859*	69 488	69.00%.	47 947	
Other Manufacturing Industries	*69 439*	12 256	81.00%.	9 927	
Construction and Public Works	**260 285**	30 593	81.00%.	24 780	
Domestic	**5 511 592**	0	0%.	0	
Services	**2 552 909**	669 592	60.00%.	401 755	2 009
Agriculture and Fisheries	**1 941 205**	374 346	81.00%.	303 220	343 593

As such, for purposes of identifying cogeneration potential, the following sub-sectors were considered:

- Sub-sectors of the transformation industry with greater satisfaction potential, both with respect to figures for heating consumption as well as the replaceable heat parcel: Foodstuffs, Beverages and Tobacco, Textiles, Paper and Paper Items, Chemicals and Plastics, Wood and Wood-Based Products, Rubber.
- Services sub-sectors where the use of cogeneration is significant, corresponding to around 40% of electrical and thermal power consumption (excluding road fuels) in this sector.

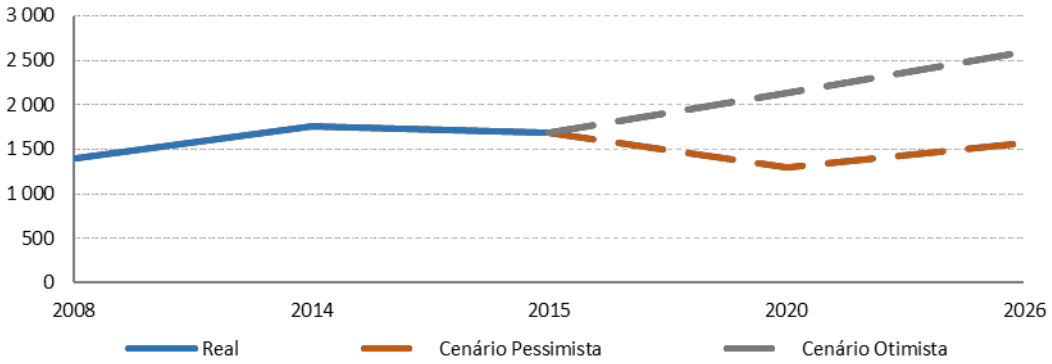
This consumption is around 1.8 Mtoe of potentially usable heat and 0.25 Mtoe of consumption for cooling, which would correspond to between 2.4 Mtoe and 2.9 Mtoe of thermal cogeneration production, or, based on the same assumptions, 11 TWh to 13 TWh of generation (29% of national consumption) and 2.4 GW to 3.0 GW of installed power. This would represent an increase of 700 MW to 1 300 MW in power in relation to current installed power of 1 759 MW.

A slight decrease in this potential can be expected due to the steep fall in consumption forecast for the industry sub-sectors of Pulp and Paper (-7.3%), and the Textiles Industry (-19.4%), precisely the two sub-sectors of greater relevance in cogeneration. There will also be a decrease in consumption for climate control in the Services Sector (-10.9%), notwithstanding a slight rise in overall consumption in this sector (1.7%). Therefore, in 2025 the achievable potential will be 2.2 Mtoe to 2.7 Mtoe in thermal cogeneration, or 10 TWh to 12 TWh of electricity generation and 2.3 GW to 2.8 GW of installed electrical power.

Economic potential for high-efficiency cogeneration

The following figure shows the evolution of economic potential for the period from 2008 to 2026.

Figure 38 – Potential economic evolution scenarios for cogeneration up to 2026 (MWe) [Source: Study on High-efficiency Cogeneration in Portugal, 2016]



Key

PT	EN
Real	Real
Cenário Pessimista	Pessimistic scenario
Cenário Otimista	Optimistic scenario

Taking into account that cogeneration units in operation in 2014 totalled 1 759 MW of installed electrical power, based on existing policies and measures, the evolution of cogeneration would be closer to the pessimistic scenario of the previous graph.

iii. Projections considering existing energy efficiency policies, measures and programmes as described in point 1.2.(ii) for primary and final energy consumption for each sector at least until 2040 (including for the year 2030)

With respect to projections for total primary energy consumption for the 2030 horizon, it is expectable that, given the policies and measures planned for implementation in the 2020-2030 period, particularly the focus on renewable energies and the decommissioning of coal-fired plants, consumption of energy will continue on a downward trend which could lead to aagr of between -0.5% and -2.3%.

As a result of the decommissioning of the two coal-fired plants, this source of energy will no longer feature in the mix of primary energy consumption, contributing significantly to a reduction in the energy bill. In 2030, renewables will have the largest weighting in the energy mix, standing at more than 40%, almost double the weighting of 2015. The weighting of natural gas will remain practically unchanged in the coming decade, and oil products will drop below 40% in the weighting.

Figure 39 - Estimated evolution in primary energy consumption for the 2030 horizon (ktoe)

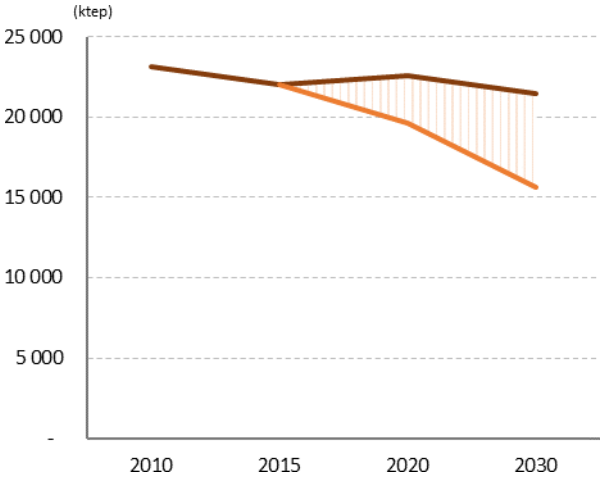


Figure 40 - Estimated evolution in primary energy consumption by type of source for the 2030 horizon (ktoe)

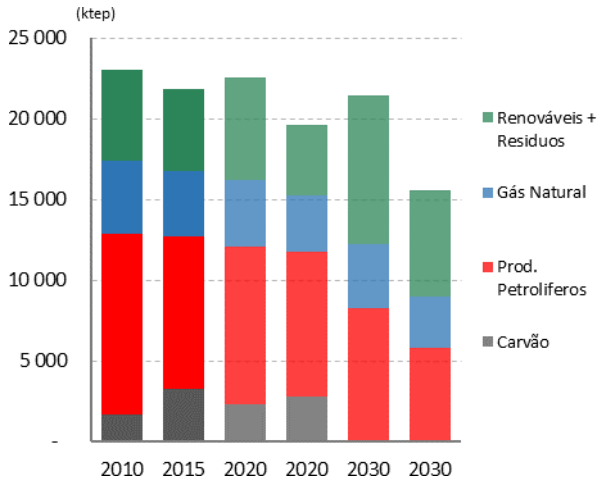
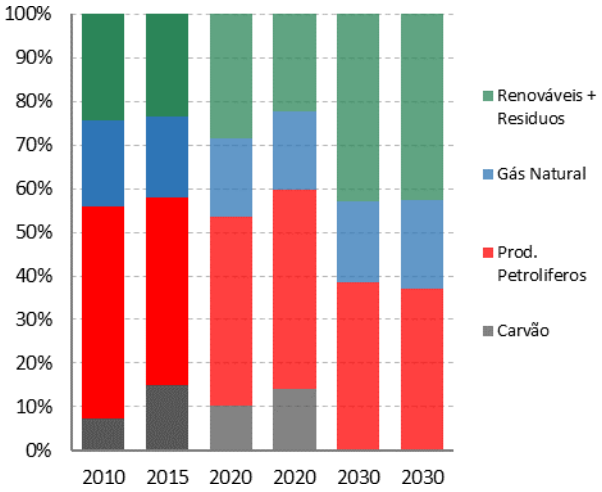


Figure 41 – Estimated evolution in primary energy consumption by type of source for the 2030 horizon



Key

PT	EN
Renováveis + Resíduos	**Renewables and Waste**
Gás Natural	**Natural gas**
Prod. Petrolíferos	**Oil products**
Carvão	**Coal**

iv. Cost-optimal levels of minimum energy performance requirements resulting from national calculations, according to Article 5 of Directive 2010/31/EU

Directive 2010/31/EU on the energy performance of buildings, known as EPBD (Energy Performance of Buildings Directive), requires Member States to apply a comparative methodology to the calculation of cost-optimal performance levels for minimum energy performance requirements in buildings and components of buildings, with a view to maintaining national regulations up to date. A specific goal is for the energy performance of reference buildings in regulations is to not exceed 15% of the calculated cost-optimal levels of minimum energy performance requirements.

Annex I, Delegated Regulation (EU) No 244/2012 which complements the EPBD, requires Member States to define reference buildings for single family buildings, apartment blocks and multi-family buildings, office buildings and also for other categories of non-residential buildings set out in Annex I, point 5(d) to (i) of the EPBD, for which specific energy performance requirements exist.

In Portugal, regulatory requirements for the energy performance of buildings are established in several different Ministerial Implementing Orders and Official Orders associated to Decree-Law No 118/2013 of 20 August 2013 which lays down the National Building Certification System (SCE), the Energy Performance Regulations for Housing (REH) and the Energy Performance Regulations for Trade and Services Buildings (RECS).

With a view to meeting EPBD requirements in relation to cost-optimal issues, a series of studies was conducted on residential buildings, offices and hotels.

In general terms it was concluded that:

- Cooling needs are always greater than heating needs;
- Although the application of thermal insulation provides improvements in performance, it does not bring advantages to the overall cost of optimal solutions;
- The cost-optimal solutions encountered have lower thermal insulation indices than those set out in legislation;
- Solutions in glass with a more demanding solar factor, with exterior shading correspond to lower energy consumption;

- However, the most efficient cost-optimal solution is double glazing in colourless glass with exterior shading;
- Cooling needs are significantly decreased when LED lighting is used, and the respective consumption also falls;
- The climate control system which has lowest energy consumption is S5 (VRV) (EV3 and EV18). The initial cost of this system is higher and although the corresponding COP and EER values are more efficient, the energy savings do not offset the investment;
- Ventilation solutions without heat recovery have the lowest energy consumption.

It should be noted that the reference building was chosen based on certificates analysed for hotels built before 1990. This resulted in a more compact shape with a consequent lower shape factor (envelope area/surrounding volume ratio). This aspect could explain why insulation-free solutions were cost-optimal.

The finding that no cost-optimal advantages are achieved with the solution using heat recovery is due to two main factors:

- Greater cooling requirements in the warm seasons;
- Height of buildings causing greater losses in extraction and subsequent increase in ventilator consumption.

Based on the methodology adopted, for average energy cost scenarios with a discount rate of 3% and an economic life cycle of 20 years, the overall cost for the variants selected were determined. The cost-optimal variant has an overall financial cost of between 388 €/m² in Faro and 425 €/m² in Porto.

From a comparative analysis between optimal performance levels and regulatory requirements, it was concluded that the reduction in primary energy consumption of the cost-optimal variant, in relation to the reference building is 33% to 35%. This means that a review of construction solutions and minimum requirements for major renovation work on hotels built before 1990 is advised. Space exists to increase the regulatory requirements of the National Building Certification System (SCE) for major renovation in hotels.

4.4. Dimension Energy security

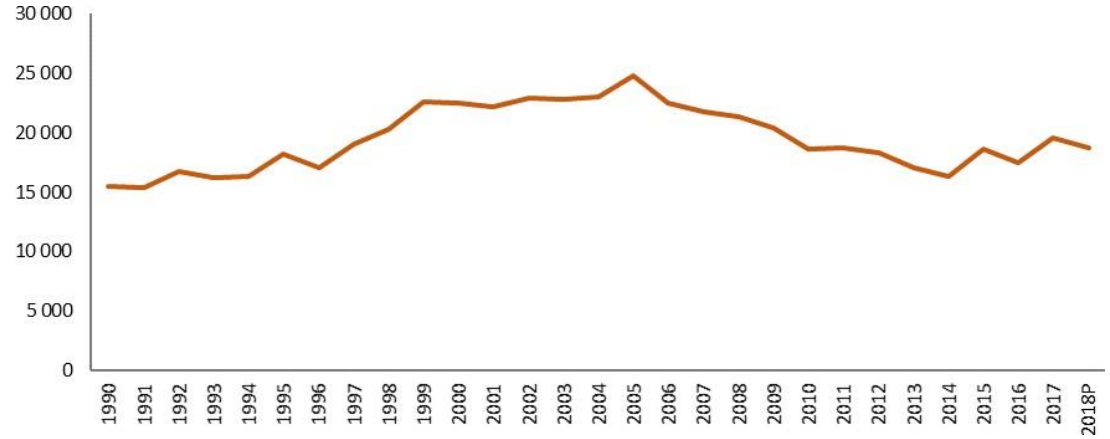
i. Current energy mix, domestic energy resources, import dependency, including relevant risks

i.1. Current energy mix and domestic energy resources

Portugal does not explore or produce, crude oil or natural gas. This means that these products are imported from third countries.

The energy import balance has fallen in recent years, recording aagr of -1.0% in the 2009-2018 period. The reduction in the import balance, which has a positive impact in reducing external energy dependency and as a result, lower energy bills for the country, was brought about through the increase in domestic energy production. This increase was particularly due to endogenous renewable sources, which led to a reduction in the imports of coal and natural gas to produce electricity. The increase in production capacity at national refineries, which provided greater response for internal consumption, also contributed to the reduction in oil product imports, and as a result, an improved import balance.

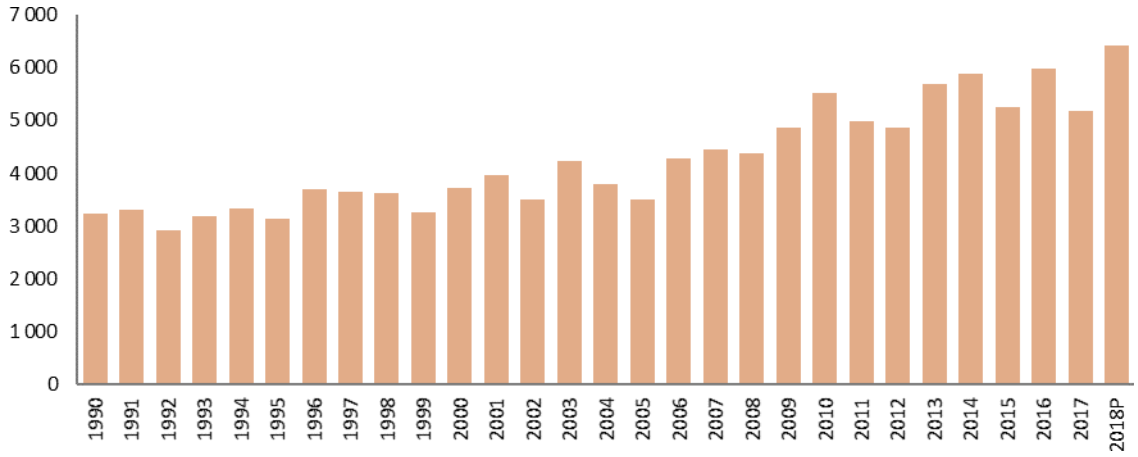
Figure 42 - Evolution of Energy Import Balance in Portugal (ktoe) [Source: DGEG]



Domestic energy production has grown in recent years, recording aagr of more than 3.1% in the 2009-2018 period, confirming the growth seen in the previous decade (3.3% from 1999 to 2006). The increase in domestic energy production has had a positive impact on reducing external energy dependency through lower imports of coal and natural gas to produce electricity.

In 2018, domestic energy production was 6 416 ktoe, representing an increase of 24% over 2017, as a result of a highly favourable hydrological year with greater availability of hydro resources to produce electricity. With respect to PEC, domestic energy production represented around 25% (+6 p.p. over figures for 2017). In the last decade from 2009-2018, domestic production represented an average of approximately 23% of PEC against an average of 16% in the period from 1999 to 2008.

Figure 43 - Evolution of Domestic Energy Production in Portugal (ktoe) [Source: DGEG]



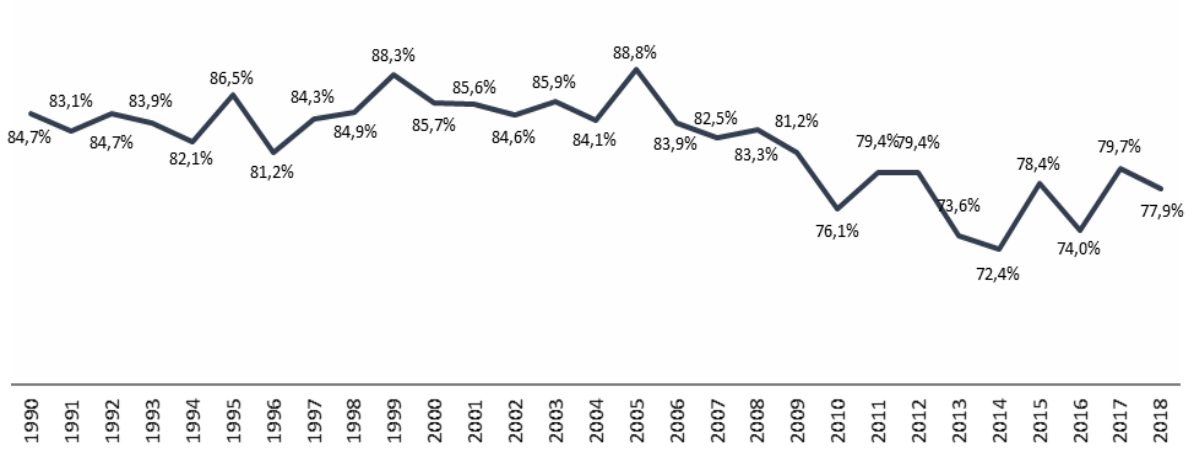
i.2. Energy dependency

One of the main challenges, and the goal of current national energy policy, is to reduce external energy dependency. Historically, Portugal has had high energy dependency of between 80% and 90% up to 2009, as the country has no fossil fuels such as oil or natural gas, which have a highly significant weighting in final energy consumption. The focus on renewable energies and energy efficiency in recent years has allowed Portugal to lower dependency to less than 80%. However, variability in hydro production, which accounts for a large share

of national electricity production, negatively influences energy dependency in dry years, as was the case in 2005 and 2008.

In 2018, energy dependency stood at 77.9% (75.9% including the contribution of heat pumps), representing a reduction of 1.8 p.p. over 2017 and a reduction of 10.9 p.p. with respect to 2005, a year which saw the highest figure for energy dependency in recent years.

Figure 44 - Evolution in Portugal's External Energy Dependency [Source: DGEG]



i.3. Relevant risks for energy supply in Portugal

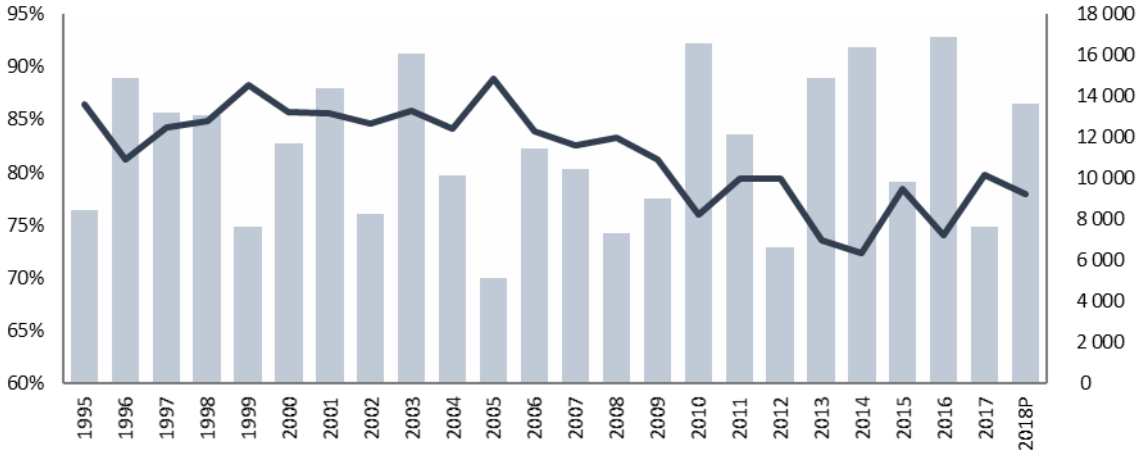
As already mentioned, Portugal does not exploit or produce coal, oil or natural gas, and as such, the supply of these energy sources to the Portuguese market is exclusively via imports from third countries.

To assess issues relating to supply security and the proper functioning of the natural gas market, a Risk Assessment is carried out on the National Natural Gas Transmission System (SNGN). This assessment, was undertaken every two years, but after the publication of Regulation (EU) 2017/1938 of 4 October (see point 2.3 of this Plan), will now be conducted every four years, or earlier should it be considered necessary. It takes into consideration relevant national and regional circumstances, such as market size, network configuration, the input and output flows of the Member State, the presence of storage and the role of gas in the energy mix, focusing particularly on the use of gas for the production of electricity and the functioning of industry. The assessment involves scenarios of exceptionally high demand and disruptions to gas supply caused by failures in the main supply infrastructure. After the Risk Assessment is carried out, a Preventive Action Plan is drawn up to define suitable measures to eliminate or attenuate the risks identified in SNGN risk scenarios, as well as an Emergency Plan which details measures to be taken during differing levels of crisis. This plan attributes responsibilities to those involved in the system so as to be able address the risk events identified and safeguard supply. It should be remembered that in accordance with the abovementioned regulation, the preparation of a common regional risk assessment is also provided for to identify and study the main risks affecting specific EU regions (referred to as Risk Groups).

With respect to the electricity production sector, historically, hydro power plants have always played a significant role in Portugal. In 2018, the weighting of hydro power in gross electricity production was 23%, contrasting with 13% in 2017. This difference was due to 2018 being considered a wet year (IPH = 1.05) while 2016 was considered a dry year (IPH = 0.47). As a result of greater availability of hydro resources for electricity production, Portugal has lower energy dependency given that it has to import less natural gas and coal, also

leading to a reduction in the energy bill. In recent years, there has been diversification of renewable sources for electricity production, particularly wind and the construction of new reversible hydro plants with pumping equipment allowing excess wind production produced at times of lower consumption to be used, enabling energy to be stored for use at times of greater consumption. This diversification has allowed the impact of dry years on the electricity production system to be attenuated. The following figure shows the evolution in external energy dependency compared to gross hydro electricity production.

Figure 45 - Relationship between external energy dependency and the production of hydro energy [Source: DGEG]



i.4. National Electricity Production System

In 2018, the national Electricity Production System recorded gross electricity production of 59.6 TWh, representing a rise of 0.3% over 2017. 51% of total production came from renewable sources (+10p.p. Over 2017) with greater incidence on hydro and wind power which together represented around 44% of all national electricity production in 2017, followed by natural gas (26%) and coal (20%). Of note is the fact that Portugal registered an export balance of 2.7 TWh in 2018, similar to that seen in 2017.

In the renewable component of electricity production, hydro power accounted for around 44%, followed by wind with 41%, biomass[35] with 10%, solar photovoltaic with 3% and geothermal, which is only produced in the Azores, with 1%.

[35] Biomass includes plant/forestry waste, sulphite liqueurs, biogas and solid urban waste (renewable part)

Figure 46 - Evolution in Gross Electricity Production and the Import Balance in Portugal (GWh) [Source: DGEG]

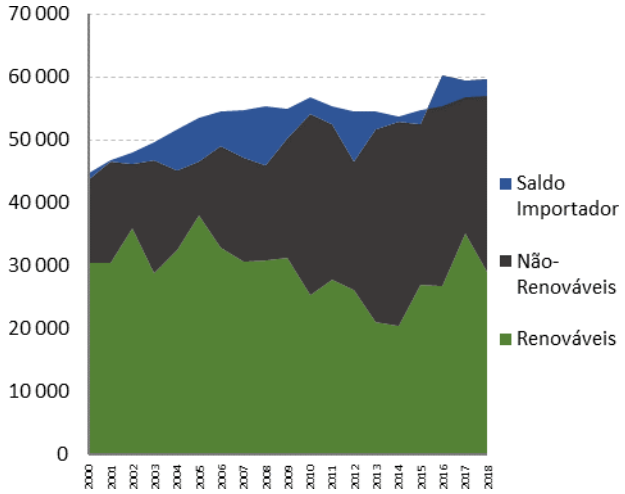
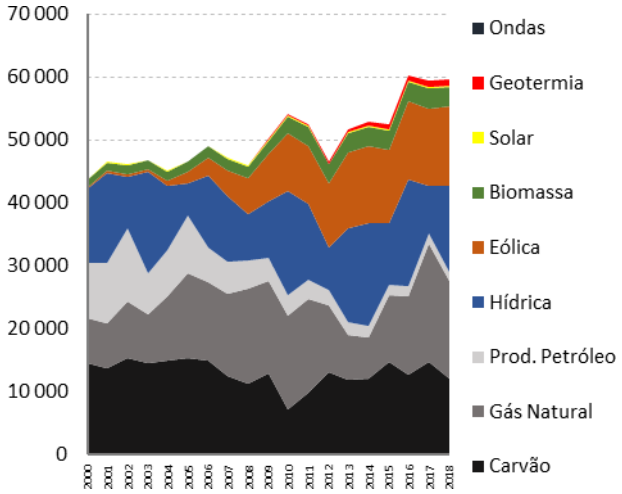


Figure 47 - Evolution in Domestic Energy Production in Portugal (GWh) [Source: DGEG]



Key

PT	EN
Saldo Importador	Import balance
Não-Renováveis	Non-renewable
Renováveis	Renewable
Ondas	Wave
Geotermia	Geothermal
Solar	Solar
Biomassa	Biomass
Eólica	Wind
Hídrica	Hydro
Prod. Petróleo	Oil products
Gás Natural	Natural gas
Carvão	Coal

In 2018, Portugal recorded a total of 22 GW of installed capacity for electricity production, 13 984 MW of which, corresponding to around 64%, came from renewable technologies. This represents an increase of 1.6% over 2016, the equivalent of 221 MW, mainly as a result of the entry into operation of new wind, solar and biomass capacity. Of total installed capacity, around 33% (7 098 MW) corresponds to hydro plants, which includes an important reversible pumping component, allowing excess production of renewable energy to be absorbed and stored. This represents around 40% of total hydro capacity, while wind represents 25% (5 368 MW), around 23% (4 984 MW) is natural gas, 9% (1 871 MW) coal, 4% (810 MW) biomass[36], around 3% (673 MW) solar, 5% (997 MW) other non-renewables[37] and 0.2% (34 MW) of other renewables[38].

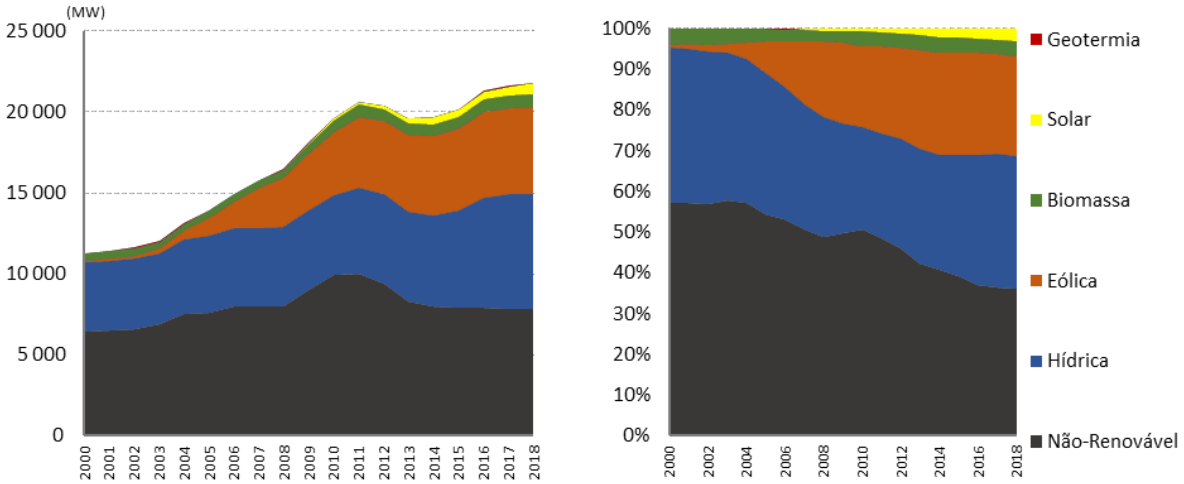
In the last decade, 2009-2018, an increase of 3.7 GW total installed capacity for electricity production was recorded, while renewables saw an increase of 4.9 GW, and non-renewable thermal production had a decrease of around 1.1 GW.

Figure 48 - Evolution in installed capacity for electricity production in Portugal by type of source (MW) [Source: DGEG]

[36] Includes plant/forestry waste, sulphite liqueurs, biogas and solid urban waste

[37] Includes fuel oils, refinery gas, diesel, industrial waste and propane

[38] Includes geo-thermal and wave



Key

PT	EN
Geotermia	**Geothermal**
Solar	**Solar**
Biomassa	**Biomass**
Eólica	**Wind**
Hídrica	**Hydro**
Não-Renovável	**Non-renewable**

ii. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

In light of the evolution foreseen for the electricity production sector in Portugal, the following table shows the evolution in expected installed capacity broken down by technology for the 2030 horizon, for purposes of compliance with the objectives set out for this sector and with impacts on other sectors.

Table 27- Perspectives for the evolution of installed capacity for the production of electricity per technology in Portugal for the 2030 horizon

(GW)	**2020**	**2025**	**2030**
Hydro	7.0	8.2	8.2 - 8.7
of which in pumping	*2.7*	*3.6*	*3,6 – 4,1*
Wind	5.4	6.8	9.3
Onshore wind energy	5.4	6.7	9.0
Offshore wind energy	0.03	0.1	0.3
Solar Photovoltaic	2.0	6.6	9.0
of which is centralised	1.5	5.8	7.0
of which is decentralised	0.5	0.8	2.0
Concentrated Solar Thermal (CSP)	0	0.1	0.3
Biomass:	0.4	0.4	0.5
Other renewables	0.03	0.06	0.1
Geothermal	0.03	0.03	0.06
Waves	0.001	0.03	0.07
Coal	1.8	0	0
Natural gas	3.8	3.8	2,8 – 3,8
Fuel/Diesel	0.4	0.3	0.3
GRAND TOTAL	**20.8**	**26.3**	**30,5 – 32,0**

NOTE: Does not include cogeneration

4.5. Dimension Internal Energy Market

4.5.1. Electricity interconnections

i. Current interconnection level and main interconnections

The National Transmission Network (RNT) currently has six 400 kV lines and three 220 kV lines connecting Portugal and Spain. Electricity interconnection between Portugal and Spain has evolved favourably in recent years so as to satisfy requests from the Iberian Electricity Market (MIBEL) and there is now greater interconnection capacity available for commercial purposes. In 2017, the average commercial interconnection

capacity was around 3 016 MW in the Portugal-Spain direction and around 2 000 MW in the Spain-Portugal direction, as can be seen in the following graph.

Figure 49 - Evolution in the annual average value of commercial interconnection capacity between Portugal and Spain (MW) [Source: REN]

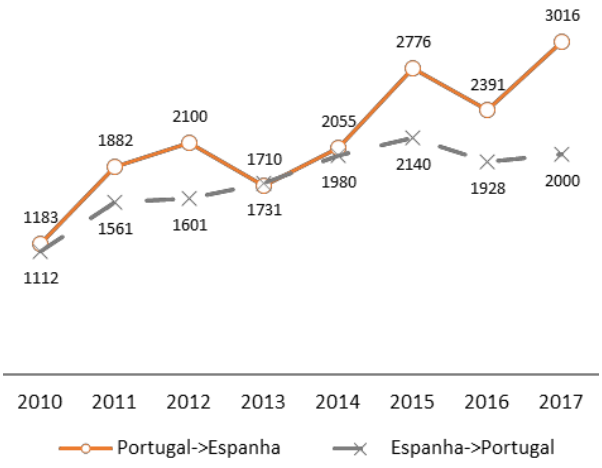
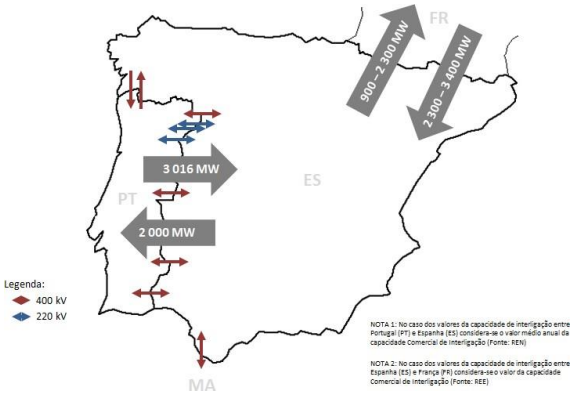


Figure 50 - Electricity interconnections in the Iberian Peninsula [Source: REN, REE]

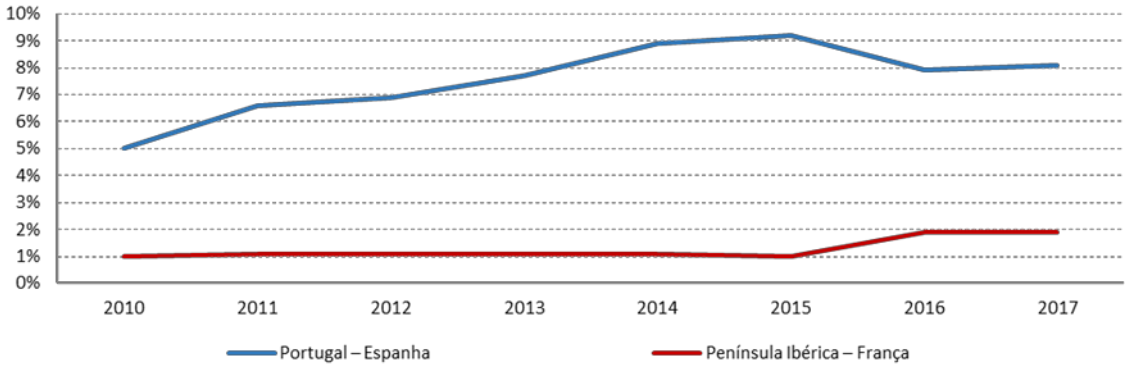


Key

PT	EN
Portugal	**Portugal**
Espanha	**Spain**
	Note 1: In the case of interconnection capacity values between Portugal (PT) and Spain (ES), the average annual value of commercial interconnection capacity is considered. (Source REN) **Note 2: In the case of interconnection capacity values between France (FR) and Spain (ES), the commercial interconnection capacity is considered. (Source REE)**

With regard to interconnection to comply with EU targets, which requires 10% of electricity interconnection by 2020 and 15% by 2030, Portugal has recorded favourable evolution. However, although Portugal has seen favourable evolution with regard to the level of interconnection with Spain, this has not been the case in relation to interconnection between the Iberian Peninsula and France, which is still far from achieving 10% by 2020, as is shown in the following table. The ambition of Portugal and Spain to ensure an effective and robust connection to the European energy market is compromised due to the bottleneck which continues to be seen at the interconnection between Spain and France through the Pyrenees. This situation means that the Iberian Peninsula operates as an 'electricity island', with the technical difficulties and challenges inherent to the large-scale penetration of renewable power and, as a result, to the ultimate aims of NECP.

Figure 51 - Ratio between interconnection capacity and installed capacity in the electricity production system between Portugal - Spain and the Iberian Peninsula - France [Source: REN, REE, analysis DGEG][39]



[39] The Portugal - Spain ratio was calculated in accordance with the ENTSO-E methodology based on the SOAF report ('For system adequacy purposes, Simultaneous Interconnection Transmission Capacity is based on 80 % of expected NTC between Portugal – Spain') The Iberian Peninsula - France ratio Includes installed capacity of both Portugal and Spain and also considers 100% of commercial interconnection capacity (NTC).

Key	
PT	**EN**
Portugal	**Portugal**
Espanha	**Spain**
Península Ibérica	**Iberian Peninsula**
França	**France**

ii. Projections relating to interconnection expansion requirements at least until 2040 (including for the year 2030)

In accordance with that set out in RMSA-E 2019, taking into account existing commitments, the following evolution is forecast in commercial interconnection capacity (in MW):

Table 28- Forecast indicative minimum values of commercial interconnection capacity [Source: REN]

	Portugal > Spain	**Spain > Portugal**
2020	2 600 MW	2 000 MW
2025	3 200 MW	3 600 MW
2030	3 200 - 3 500 MW	3 600 – 4 200* MW
2040	4 000** MW	4 700** MW

*Taking into account the targets set out in NECP 2030 for evolution in production up to 2030, estimating for this horizon an *interconnection ratio* falling between 11% and 15%

**The capacities indicated for 2040 correspond to values identified as Target Capacities for the Portugal-Spain border in the TYNDP 2018 – Ten Year Network Development Plan studies. However, the network necessary in Portugal and Spain have not as yet been identified so as to achieve such capacity.

4.5.2. Energy transmission infrastructure

i. Key characteristics of the existing electricity and gas transmission infrastructure

i.1. Electricity

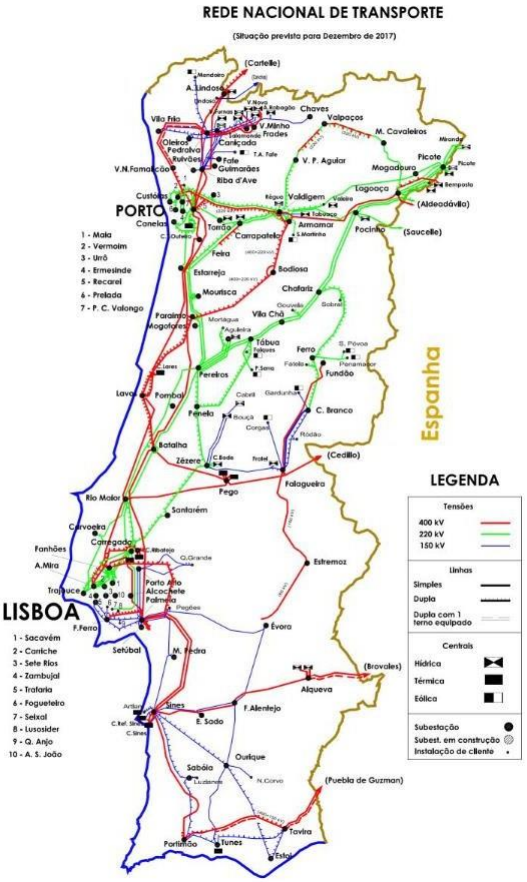
The National Electricity Transmission Network (RNT) includes installations in mainland national territory which ensure the transmission of power from high-voltage electricity production centres to high-density consumption areas, as well as to neighbouring countries (only Spain), through very high voltage lines and facilities which step down voltage levels and allow the control of power flow. Currently, the RNT has a total of 8 907 km of network, transformation power of 37 382 MVA, 66 substations, 12 step-down stations, 2 branching stations and 1 transition station. Evolution in the RNT can be seen in the following table and figure.

Table 29- Main characteristics of the National Electricity Transmission Network [Source: REN]

	2015	**2016**	**2017**	***% 2015/2016***	***% 2016/2017***
Length of lines, km	**8 805**	**8 863**	**8 907**	*+0.7% (+58 km)*	*+0.5% (+44 km)*
400 kV	2 632	2 670	2 714	*+1.4% (+38 km)*	*+1.6% (+44 km)*
220 kV	3 611	3 611	3 611	*0%.*	-
150 kV	2 562	2 582	2 582	*+0.8% (+20 km)*	-
Transformation power (MVA)	**36 673**	**36 636**	**37 382**	*-0.1% (-37 MVA)*	*2.0% (+746 MVA)*
Autotransformation (VHV/VHV)	14 040	13 890	14 340	*-1.0% (-150 MVA)*	*+3.2% (+450 MVA)*
Transformation (VHV/HV)	22 313	22 426	22 722	*+0.5% (+113 MVA)*	*+1.3% (+296 MVA)*
Transformation (VHV/MV)	320	320	320	-	-

The following figure shows the RNT map.

Figure 52 - Map of the National Electricity Transmission Network in 2017 [Source: REN, 'Indicative interconnection capacities for commercial purposes in 2017']



Key

PT	EN
Rede Nacional de transporte	**National Transmission Network**
Situação prevista para Dezembro de 2017	**Situation forecast for December 2017**
Legenda	**Key**
Tensões	**Voltage**
Simples	**Single**
Dupla	**Double**
Dupla com 1 terno equipado	**Double with 1 connection**
Centrais	**Power Plants**
Hídrica	**Hydro**
Térmica	**Thermal**
Eólica	**Wind**
Subestação	**Sub-station**
Subestação em construção	**Sub-station under construction**
Instalação de cliente	**Client facility**

i.2. Natural gas

The National Transmission, Storage Infrastructure and Liquefied Natural Gas Terminal Network (RNTIAT) consists of all the infrastructure for receiving and transmitting natural gas (NG) by gas pipeline, underground storage and reception, storage and regasification of Liquefied Natural Gas (LNG). RNTIAT consists of the National Natural Gas Transmission Network (RNTGN), the Sines Liquefied Natural Gas Terminal (TGNL) and the Carriço Underground Storage facility (AS) in Pombal.

The RNTGN is the infrastructure used for the reception, transmission and delivery of high-pressure NG in Portugal, from input to output points. It is formed by two main axes: a South-North axis which connects the Sines LNG Terminal to the Valença do Minho interconnection, supplying NG to the Portuguese coastline, where the most densely populated cities are located. There is also a take-off line to Mangualde; and an East-West axis between the Campo Maior interconnection and the Carriço US facility, with a take-off line to Guarda. In 2013, the connection was concluded between the take-off lines of both axes, connecting Mangualde to Guarda, which

allowed a reinforcement of capability to satisfy demand in central and northern Portugal. All RNTGN delivery points (GRMS - *Gas Regulation and Metering Stations*) have total output capacity of 666 GWh/day, equivalent to 2 330 $km^3(n)/h$. The following facilities form part of the RNTGN: 1 375 Km of main gas pipeline and high-pressure branch lines for the transmission of natural gas; 85 gas regulation and metering stations at the delivery points (GRMS); 66 Junction stations (JCT); 45 Block valve stations (BV); 5 Interconnection junctions (ICJCT); 2 Custody Transfer Stations (CTS).

NG may be delivered directly to high-pressure connected clients, distribution networks which make up the national NG distribution network, the network interconnected to the Spanish gas system and to the Carriço underground storage caverns.

The most recent developments in the RNTGN have focused on connecting new delivery points and remodelling a number of pressure reduction and metering stations so as to adapt them to new operating conditions and gas flows to be supplied.

There are two interconnections between the RNTGN and the Spanish transmission network: Campo Maior - Badajoz and Valença do Minho - Tuy. Both interconnection points have input and output capacity, and total VIP capacity (Campo Maior + Valença do Minho) is 144 GWh/day.

Table 30- NG interconnection capacities between Portugal and Spain. [Source: REN]

Interconnection	Daily Capacity
Campo Maior link	Input Capacity: 134 GWh/day, equivalent to 470 $km^3(n)/h$ Output Capacity: 35 GWh/day, equivalent to 123 $km^3(n)/h$
Valença do Minho	Input Capacity: 10 GWh/day, equivalent to 35 $km^3(n)/h$ Output Capacity: 25 GWh/day, equivalent to 88 $km^3(n)/h$

The Sines Liquefied Natural Gas Terminal (LNGT) is strategically located on the European Atlantic coast and includes all of the infrastructures for receiving and dispatching methane carrier vessels, storage and regasification of LNG to the transmission network. It also loads tanker trucks with LNG. The main characteristics of the Sines LNG Terminal include:

- Reception and unloading of methane carrier vessels: The port facility includes a mooring quay, articulated unloading arms and unloading lines and LNG vapour recirculation and return lines. Unloading capacity is 10 000 m^3/h of LNG for methane carrier vessels with volumes from 40 000 to 216 000 m3 of LNG.
- LNG storage: After unloading, the LNG is stored in tanks. Storage capacity is 2 569 GWh, corresponding to two 120 000 m^3 tanks of LNG and one tank of 150 000 m3 of LNG.
- Regasification to the RNTGN: Regasification is a physical process to vaporise LNG which uses heat exchange of the gas with sea water in atmospheric vaporisers. To carry out this process, the infrastructure has seven atmospheric vaporisers with a unit capacity of 64 GWh/day (equivalent to 225 000 $m^3(n)/h$). Nominal emission capacity is 321 GWh/day (equivalent to 1 125 000 m3(n)/h), with peak time capacity of 1 350 000 m3(n)/h).
- LNG filling bays: The Sines LNG terminal allows LNG tanker trucks to be loaded, which transport gas to autonomous regasification units (UAG) in areas of Portugal which cannot be supplied by the high-pressure natural gas network. The LNGT has three filling bays with a total capacity of 175 m^3/h of LNG.
- Loading of methane carrier vessels: The Sines LNG terminal is also capable of carrying out *the total* or partial loading of methane carrier vessels using the same port facility and vessel unloading equipment. Capacity for this activity is 1 500 m^3/h of LNG.

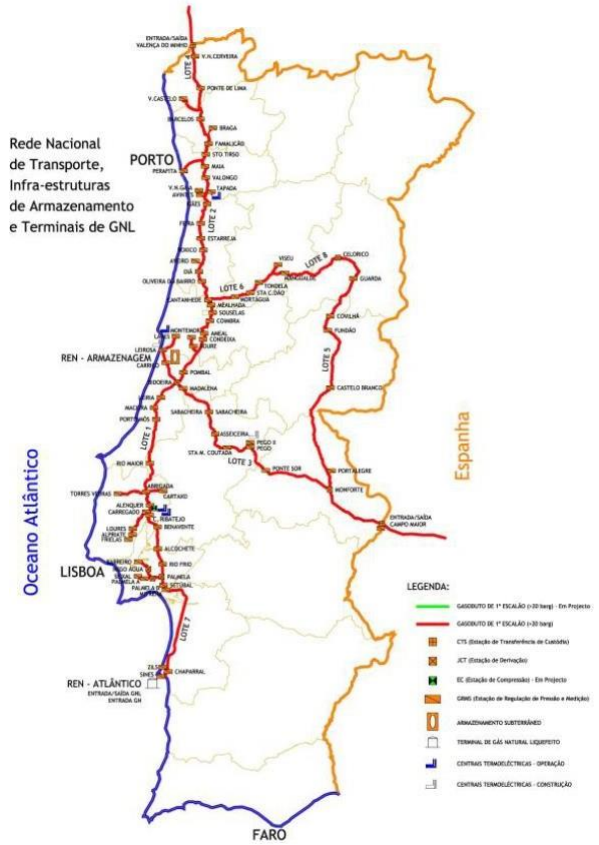
The expansion of the Sines LNG Terminal, which was concluded in July 2012, provided an increase in useful storage capacity of 62.5%, to 390 000 m^3 de GNL, an increase in gas issue capacity of 50%, to 1 350 000 m^3/h, adaptation of the *jetty* to receive large-capacity methane tankers, and the implementation of a series of procedural reinforcements to maximise infrastructure availability and provide a high level of operating safety.

As a result, the Sines Terminal now has favourable access conditions for a greater number of agents, providing greater flexibility in the management of imported volumes and creating unique conditions to receive tankers of LNG from more remote and diversified sources. This has contributed to increasing the competitiveness of the sector in Portugal and to the supply security of the SNGN.

With regard to the underground storage (US) at Carriço, NG is stored under high-pressure in caverns created in a saline mass, at depths of over one thousand metres. There are currently six caverns with total storage capacity of 3 839 GWh (322.6 Mm^3), which use the same surface gas station providing bidirectional flow. In other words, injection of gas from the transmission network to the caverns and the withdrawal of gas from the caverns to the transmission network. The Carriço US facility injection capacity is 24 GWh/day (83 000 m^3(n)/h) and withdrawal capacity is 129 GWh/day (450 000 m^3(n)/h). This infrastructure is vital for constituting the security reserves necessary to ensure supplies to the country in the event of a supply crisis. It also provides conditions to optimise logistics for commercial agents working in Portugal and in the Iberian Peninsula.

The following figure shows the RNTIAT map.

Figure 53 - Map of the National Transmission, Storage Infrastructure and Liquefied Natural Gas Terminal Network in 2017 [Source: REN]



Key

PT	EN
Rede Nacional de transporte, infraestruturas de armazenamento e Terminais de GNL	Map of the National Transmission, Storage Infrastructure and Liquefied Natural Gas Terminal Network
Oceano Atlântico	Atlantic Ocean
Espanha	Spain
Gasoduto de 1º escalão – Em projeto	1st Scale gas pipeline – under design
Gasoduto de 1º escalão	1st Scale gas pipeline
Estação de transferência de custódia	Custody transfer station
Estação de Derivação	Branch station
Estação de … Em Projeto	EC Station under construction
Estação de Regulação de Pressão e Medição	Pressure regulating and metering station
ARMAZENAMENTO SUBTERRÂNEO	Underground storage
TERMINAL DE GÁS NATURAL LIQUEFEITO	Liquefied Natural Gas Terminal
CENTRAIS TERMOELÉTRICAS: OPERAÇÃO	Thermoelectric power plants: Operation
CENTRAIS TERMOELÉTRICAS - CONSTRUÇÃO	Thermoelectric power plants: Construction

ii. Projections of network expansion requirements at least until 2040 (including for the year 2030)

ii.1. Electricity

In order to meet Community requirements on interconnections, as well as the need to reinforce internal networks, a wide-ranging series of actions and projects exists which include (as indicated in point 2.4. of this plan):

- In 2021-2022, with the entry into service of the 400-kV interconnection line between Minho (PT) and Galicia (ES) (as previously mentioned, identified under the Madrid Declaration, and also a European Commission Project of Common Interest), it will be possible to overcome the existing network restrictions and achieve, in both directions, minimum commercial interconnection capacity of 3 000 MW;
- By 2025, a slight increase is estimated in interconnection capacity, particularly in the Spain - Portugal direction. This estimate is based on forecast evolution for demand in both systems. In the Portuguese case, the entry into service of the new 400-kV Pedralva-Sobrado line is planned, which, in addition to avoiding a reduction in interconnection capacity, will also allow the flow of renewable origin electricity, essentially hydro;
- For the 2030 horizon, very long-term analyses have already been conducted by the PT and ES transmission system operators (REN and REE) under the Ten-Year Network Development Plan *2016* (TYNDP), which led to estimated interconnection capacity values which were slightly higher than those forecast for 2023-2025;
- From a longer perspective up to 2040, commercial capacities are based on analyses conducted (with the scenarios 'Sustainable Transition' and 'Distributed Generation') under the TYNDP 2018 by REN and REE. Possible reinforcement of the network or new interconnections required to achieve these interconnection capacity figures have not yet been identified.

Also of note in the electricity sector are the projects to reinforce internal networks (transmission and distribution) to connect and accept renewable power production (to achieve national potential in this type of electrical power production) and other projects to satisfy large consumer needs, more specifically the following.

- 400-kV Fundão-Falagueira connection, to accommodate renewable energy from this region;
- Double 400-kV line between Vieira do Minho - Ribeira da Pena; Ribeira da Pena substation; 400-kV Ribeira da Pena – Feira connection to link the Tâmega hydro power plants.
- 400-kV passage of the Falagueira-Estremoz-Divor-Pegões axis, which is vital for meeting the technical feed specificities to the railway line between Évora-Elvas/Caia.

With respect to the 2040 horizon, depending on the evolution seen in the Portuguese and Spanish electricity systems, more specifically with regard to renewable power generation, it will be necessary to assess, in addition to possible network reinforcement, the need for new interconnections.

ii.2. Natural gas

In order to meet commitments made on a European level and based on national energy policy, more specifically with respect to internal market integration and supply security, and with a view to creating a more robust, efficient and interconnected national natural gas system, Portugal intends to develop the respective transmission and distribution network, and currently has in hand projects which will contribute to this aim. In order to meet such requirements, a wide-ranging series of actions and projects exists which include (as indicated in point 2.4.2 of this plan):

- The 3rd Interconnection Project between Portugal and Spain (with recognised benefits in relation to supply security and integration of the European Market) which is dependent on the completion of the STEP/MIDCAT project for the new interconnection between Spain and France, both projects are expected to be completed by 2030;

- Also planned for the gas sector are projects which could increase the use of LNG and improve LNG reception capacity at the Sines Terminal, to strengthen Portugal's role as an 'entry point' for natural gas into the internal market/European gas system.

4.5.3. Electricity and gas markets, energy prices

i. Current situation of electricity and gas markets, including energy prices

i.1. Electricity Market

Since September 2006, all electricity customers in mainland Portugal have been able to choose their supplier. In a total of around 6.2 million customers in the electricity market in Portugal at the end of 2018, the Free Market (FM) now represents around 5.0 million customers, corresponding to around 81% of all market customers. Remaining customers belong to the Regulated Market (RM) which are supplied by the Supplier of Last Resort (SoLR). Most customers which remain in the RM are domestic users. The vast majority migrated to the FM.

Table 31- Number of clients in the national electricity market per voltage level in 2018 (estimated) [Source: ERSE]

	Free market	Regulated market
VHV	0	73
HV	2	305
MT	692	23 892
SLV	1 510	34 516
NLV	1 156 876	4 992 949
Total	**1 159 080**	**5 051 735**

A gradual increase has also been seen in the number of suppliers working in the different market segments including the retail market. It can be expected that the benefits of more competition through the greater choice available, better prices and more competition between agents will be enjoyed by industrial and retail consumers.

With the publication of Law No 42/2016 of 28 December 2016 and in accordance with the respective Article 171(1)(a), the Portuguese Government extended the deadline for abolishing transitional tariffs for the supply of electricity to normal low-voltage final consumers. The new termination date is 31 December 2020.

With respect to electricity prices charged in Portugal in 2018, average prices for electricity in the domestic sector stood at 0.227 €/kWh (band DC) representing a slight increase of around 0.5% over 2017. The average price for industry stood at 0.141 €/kWh (band IC), which is the same average price charged in 2017.

Table 32- Electricity prices per sector in Portugal (€/kWh) [Source: DGEG]

		Domestic (DC band[40])			Industry (IC band[41])		
		Prices without fees	Prices without VAT	Prices with fees	Prices without fees	Prices without VAT	Prices with fees
2017	1st Semester	0.111	0.186	0.228	0.084	0.115	0.141
	2nd semester	0.108	0.181	0.223	0.084	0.115	0.141
2018	1st Semester	0.101	0.183	0.225	0.078	0.112	0.138
	2nd semester	0.103	0.186	0.229	0.081	0.117	0.144

i.2. Natural Gas Market

In Portugal, since the beginning of 2010, all consumers have had the right to choose their NG supplier. This liberalisation process in the NG market has meant that all large consumers (annual consumption greater than 1 million m^3 of NG) are now in the free market. Similarly, the vast majority of industrial consumers (annual consumption of between 10 000 m^3 and 1 million m^3 of NG), also opted for the more favourable conditions offered by suppliers. Moreover, significant numbers of residential consumers have also chosen free market suppliers.

In a total retail market of around 1.5 million customers, the free market accounted for approximately 1.2 million consumers at the end of 2018, representing 81% of all NG market customers in Portugal.

Table 33- Number of clients in the national NG market by type of client in Dec. 2018 [Source: ERSE]

	Free market	Regulated market
Large Consumers	404	32
Industrial	4 018	613
SME	78 363	24 867
Residential	1 113 530	260 967
Total	**1 196 315**	**286 479**

A gradual increase has also been seen in the number of suppliers working in the different market segments including the retail market. It can be expected that the benefits of more competition through the greater choice available, better prices and more competition between agents will be enjoyed by industrial and retail consumers.

Ministerial Implementing Order No 144/2017 of 24 April 2017, amending Ministerial Implementing Order No 59/2013 of 11 February 2013, sets 31 December 2020 as the limit date for the requirement to supply NG, by suppliers of last resort, to end customers with annual consumption less than or equal to 10 000 m^3 who do not exercise their right to change to a free market supplier.

In 2018, average prices for NG in the domestic sector stood at 21.421 €/GJ (band D2) representing a reduction of 1.9% over 2017. Average prices for NG in the industry sector stood at 9.711 €/GJ (band I3) representing an increase of 3.5% over 2017.

[40] 2 500 kWh < Consumption < 5 000 kWh

[41] 500 MWh < Consumption < 2 000 MWh

Table 34- Natural Gas prices per sector in Portugal (€/GJ) [Source: DGEG]

		Domestic (Band D2[42])			Industry (Band I3[43])		
		Prices without fees	Prices without VAT	Prices with fees	Prices without fees	Prices without VAT	Prices with fees
2017	1st Semester	15.728	17.459	21.475	7.522	7.739	9.520
	2nd semester	16.248	18.037	22.186	7.311	7.523	9.253
2018	1st Semester	15.751	17.132	21.072	7.400	7.586	9.330
	2nd semester	16.272	17.699	21.770	8.005	8.205	10.092

i.3. Prices of the main fuels

With respect to the prices of the main energy products in Portugal, the average RP for diesel stood at 1.343 €/litre in 2018, representing an increase of 8% over 2017, while the average price for petrol 95 stood at 1.537 €/litre, representing an increase of 5% over 2017.

Table 35- Price of Diesel in Portugal (€/litre) [Source: DGEG]

	2016	2017	2018	*% 2017/2016*	*% 2018/2017*
Price without fees (PWF)	0.458	0.543	0.621	18.6%.	14.3%.
VAT	0.209	0.232	0.251	11.0%.	8.2%.
VAT + Others[44]	0.451	0.466	0.471	3.3%.	1.0%.
Retail price (RP)	1.119	1.242	1.343	11.0%.	8.2%.

Table 36- Price of Petrol 95 in Portugal (€/litre) [Source: DGEG]

	2016	2017	2018	*% 2017/2016*	*% 2018/2017*
Price without fees (PWF)	0.444	0.538	0.590	21.1%.	9.8%.
VAT	0.256	0.273	0.287	7.0%.	5.1%.
VAT + Others[45]	0.668	0.652	0.659	-2.4%.	1.2%.
Retail price (RP)	1.367	1.463	1.537	7.0%.	5.1%.

i.4. Social Tariff on Energy

In 2010, the social tariff was created for the supply of electrical power to be applied to economically vulnerable final customers, approved by Decree-Law No 138-A/2010 of 28 December 2010. As part of the liberalisation process for the energy sector and to protect consumers, the aim of this law was to ensure access by all consumers to the essential service of the supply of electrical power, regardless of which supplier was used. This guarantee led to the need to ensure supply to economically vulnerable consumers. The growing prices and volatility of energy costs internationally and the intention to further standardise the electricity market also justified the need to establish specific measures to protect such consumers in line with European guidelines on the internal electricity and natural gas markets. A social tariff protects the interests of families and other groups of economically vulnerable consumers through a tariff model providing them with stability through discounts.

[42] 20 GJ < Consumption < 200 GJ
[43] 10 000 GJ < Consumption < 100 000 GJ
[44] Road Service Contribution and Value of CO2
[45] Road Service Contribution and Value of CO2

In 2014, the concern was to ensure access by consumers considered to be more disadvantaged in the universe of final low-voltage electrical power consumers. The aim was to extend the number of beneficiaries of the social tariff to around 500 000 consumers with electrical power supply contracts and create conditions so that the discount applied to these beneficiaries was greater than that being applied at the time. With a view to increasing the number of social tariff beneficiaries, the social discounts for access to the essential service of electrical power and natural gas supply, implemented through Decree-Law No 138-A/2010 of 28 December 2010, amended by Decree-Law No 172/2014 of 14 November 2014, for electrical power, and Decree-Law No 101/2011 of 30 September 2011, for natural gas, are now automatically granted to more economically vulnerable end customers after applicable legislation was redesigned through Law No 7-A/2016[46] of 30 March 2016. According to data provided by ERSE, this procedure contributed to the number of beneficiaries increasing from 154 648 in March 2016 to 820 527 in September 2017. This measure, was initially launched on 28 December 2010 via Decree-Law No 138-A/2010, and as of 1 July 2016, automatically assigned the required status to customers meeting economic and/or social vulnerability criteria, confirmed by the Tax and Customs Authority and/or the Social Security Institute, in accordance with Law No 7-A/2016 of 30 March 2016.

The automatic recognition system to assign the social tariff for energy removes the requirement from the customer to request recognition of such status. In truth, the creation of this automatic system allows economically vulnerable customers to access the social tariff and avoid unnecessary bureaucracy and costs, and provides a procedure with greater social fairness. It should also be noted that this discount provides savings of dozens of euros per year for many families. Automatic recognition is carried out by the I.T. System at the DGEG, which cross-references data in accordance with the protocols governing access and transmission of information among different agents in the energy sector and Public Administration bodies holding the required data, more specifically the Tax and Customs Authority and the Social Security Institute.

The discount applied to access tariffs to electricity networks, applicable as of 1 January 2018, as provided for in Article 3(2) of Decree-Law No 138-A/2010 of 28 December 2010, in the wording given by Decree-Law No 172/2014 of 14 November 2014 and Law No 7-A/2016 of 30 March 2016, is required to correspond to a value allowing a discount of 33.8 % on the transitional sale tariffs to end electricity customers, excluding VAT, other taxes, contributions, levies and late-payment interest which apply in accordance with Official order No 9081-C/2017 of 11 October 2017. The discount applied to access tariffs to natural gas networks, applicable as of 1 July 2017, as provided for in Article 3(2) of Decree-Law No 101/2011 of 30 September 2011, in the wording given by Law No 7-A/2016 of 30 March 2016, is required to correspond to a value allowing a discount of 31.2% on the transitional sale tariffs to final natural gas customers, excluding VAT, other taxes, contributions, levies and late-payment interest which apply, and such application shall not be considered for purposes of other supports currently in effect, in accordance with Official order No 3229/2017 of 11 April 2017.

Table 37- Number of consumers with Social Energy Tariff in Portugal

	2016	**2017**	**2018**
Electricity	786 598	777 085	770 094
Natural gas	36 819	34 403	35 412
Total	**823 417**	**811 488**	**805 506**

[46] State Budget Law for 2016

ii. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

N/A

4.6. Dimension Research, innovation and competitiveness

i. Current situation of the hypocarbon sector and, as far as possible, its position in the world market (this analysis should be conducted on a Union or international level)

Portugal has made considerable effort to apply low-carbon technologies to its energy *mix*, more specifically in relation to European commitments. Of note are areas such as environmental sustainability, renewable energies and energy efficiency. Investment in infrastructure, particularly to reinforce energy interconnections, plays a vital role in supply security, promoting integration into new energy markets and promoting cooperation between countries, allowing resources to be shared.

In the last decade, aware of the need to meet the challenges created by climate change and reduce its dependency on fossil fuels, Portugal has followed a policy to promote renewable energies under EU commitments, focusing on hydro, wind, biomass, solar and geothermal power. This focus has allowed the country to position itself near the top of the ranking for energy production from renewable sources.

This transitional process required a change in the energy production model where it became vital to develop policies and measures to support the generation of decentralised renewable energy. Strategies have been established for research, innovation and competitiveness so as to facilitate investment in low-carbon technologies and smart networks, allowing cooperation to be promoted among market players, maximising trans-national competition and supporting the setting up of innovative energy services companies.

This focus drives the development of the national economy, having created an entirely new industrial and corporate segment, generating employment, promoting regional development, stimulating the export of goods and services, driving regional and innovation which attracts international investment and stimulates the internationalisation of national companies. It has also allowed external energy dependency to be significantly reduced.

In relation to research and innovation, of note is the implementation of international groups as part of the European Strategic Energy Technology Plan (SET Plan) in areas of low-carbon technology with a view to applying clean technologies at lower costs. These technologies include ocean energy, geothermal energy, solar energy focusing on concentrated solar power (CSP), energy efficiency in industry and buildings, energy systems, smart communities and solutions with focus on consumers, biofuels and bioenergy. The underlying vision is also aligned with Portugal's multi-level strategy where brainstorming among stakeholders has been promoted is areas such as energy efficiency, bioengineering and hydrogen to meet the different challenges facing society. Inter-institutional cooperation has also been promoted and networks have been established in technologies for renewable energy, energy storage, energy efficiency and also in the fields of hydrogen and biomethane.

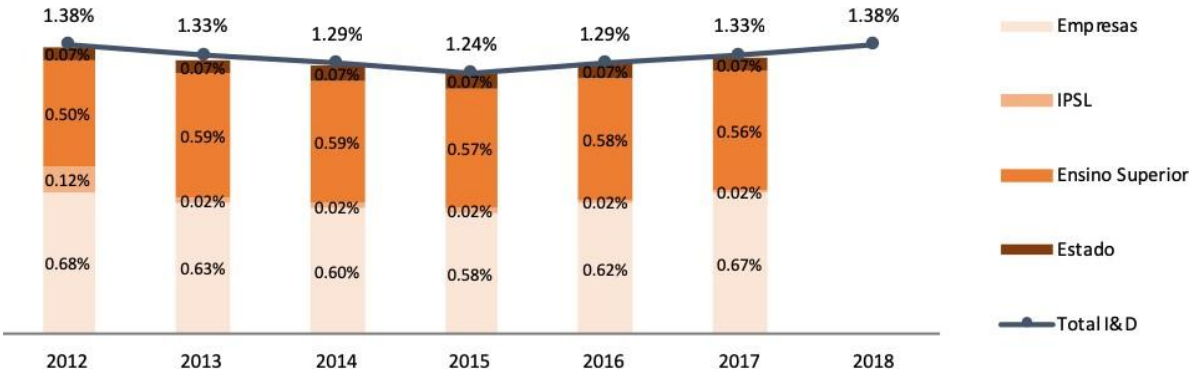
However, to achieve greater success, greater effort will be necessary on a technological level in solar and wave energy and in the development of a comprehensive portfolio of renewable technologies with good cost effectiveness. It will be necessary to go beyond the technologies which have already

attained maturity and use resources to support more innovative technologies allowing substantial savings in costs and in terms of GHG emissions.

ii. Current level of public and private research and innovation spending on low-carbon-technologies, current number of patents, and current number of researchers

In Portugal, investment in Research and Development (R&D) in recent years has fluctuated. In 2018, total investment recovered the value for 2012, 1.38% of GDP. Also, in overall terms, the following figure shows investment levels by sector during the 2012-2017 period, as was as the objective for 2010, as a percentage of GDP, demonstrating the importance of effort by companies and higher education institutions in total investment in research and innovation.

Figure 54 – R&D investment levels in relation to GDP by sector [Source: DGEEC]



Key

PT	EN
Empresas	**Companies**
IPSL	**Private non-profit institutions**
Ensino Superior	**Higher education**
Estado	**State**
Total I&D	**Total R&D**

Registration of patents in Portugal demonstrates that national skills exist with respect to hypocarbon technologies. Excluded from this type of technology are those connected to nuclear fusion and fission as they are not considered to be within the scope of current or future national energy policy. The results are shown in the following table:

Table 38- Registration of patents in Portugal [Source: INPI]

Technological Area/Units Registered													
Wind	**No**	**Solar**	**No**	**Waves**	**No**	**Biomass:**	**No**	**Hydro**	**No**	**Geothermal**	**No**	**Other**	**No**
Wind	**30**	Solar	**94**	Wave power.	**45**	Biomass:	**3**	Hydro	**5**	Geothermal	**2**	Production of hydrogen	**21**
Wind engines	**3**	Solar collector	**25**	Tidal power	**8**	Bio fuel	**6**	Hydro power	**8**	-	-	Storage of Energy	**27**
Wind turbine	**18**	Solar panel	**26**	Ocean energy	**1**	Biodiesel	**8**	-	-	-	-	-	-
-	-	Solar thermal	**16**	Sea currents	**4**	Bioethanol	**4**	-	-	-	-	-	-
-	-	Solar Photovoltaic	**4**	Wind power	**3**	Biogas	**6**	-	-	-	-	-	-
-	-	Concentrated solar power	**5**	Oscillating water column	**3**	Biomethane	**2**	-	-	-	-	-	-

Of note is the importance of human resources. Over the last ten years, there has been a significant reduction in the total number of researchers in Portugal. The following table shows the breakdown in research personnel by sector of execution in full-time equivalent units (FTE). Similarly, the total values presented below may not

correspond to the sum of the parcels due to rounding up.

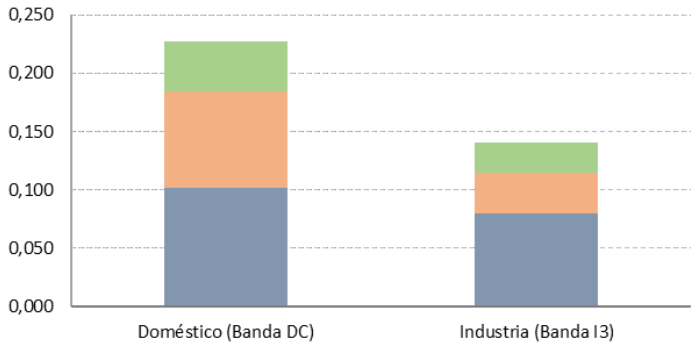
Table 39- Breakdown in research personnel by sector of execution [Source: DGEEC]

	Total	Businesses		State		Higher Education		PFPI[47]	
	TSI	TSI	%	TSI	%	TSI	%	TSI	%
2014	46 878	17 348	37%	2 037	4%	26 870	57%	622	1%
2015	47 999	18 283	38%	2 066	4%	27 001	56%	649	1%
2016	50 406	19 367	38%	2 098	4%	28 265	56%	676	1%
2017	54 995	22 022	40%	2 212	4%	30 078	55%	683	1%
2018	58 154	CHAPTER 23 662 —	41%	2 283	4%	31 451	54%	759	1%

iii. Breakdown of current elements of the price which constitute the three main components (power, network, taxes/charges)

Analysing the price structure of electricity in Portugal in the domestic sector, it can be seen that in 2018 the Power and Network component represented 45% of the Retail price (RP), Taxes and Charges represented 36% and VAT 19%. In industry, the Power and Network component represented 57% of RP, Levies and Taxes represented 25% and VAT 19%.

Structure of the price of Electricity in Portugal by sector (€/kWh) [Source: DGEG]



Key

PT	EN
Doméstico (Banda DC)	
Indústria (Banda I3)	

iv. Description of energy subsidies, including fossil fuels

Although there are several direct and indirect taxes on energy, of particular note are taxes on oil and energy products, which are highlighted for this reason in this analysis.

Tax on petroleum and energy products (ISP)

Nationally, tax on oil and energy products and electricity is governed by the Code of Special Consumer Taxes (CIEC), approved by Decree number 73/2010 of 21 June 2010, which transposed Council Directive 2008/118/EC of 16 December 2008 concerning the general arrangements for excise duty ('Horizontal Directive') and the ('Vertical') directives to standardise special consumer taxes which provide for the Tax on oil and energy products (ISP).

The following oil and energy products are subject to tax:

[47] Private for-Profit Institutions

- Any other products to be used, placed on sale or to be consumed as a fuel;
- Other hydrocarbons, with the exception of peat, to be used, placed on sale or to be consumed as a fuel;
- Electricity covered by Code NC 2716.

CIEC further sets out the products which benefit from total or partial exemption and the products taxed at a reduced rate. In addition to the exemptions provided for in the General Part of CIEC, applicable under Council Directive 2008/118/EC of 16 December 2008 concerning the general arrangements for excise duty and repealing Directive 92/12/EEC ('Horizontal Directive'), which apply to oil and energy products and to electricity, and which are set out in Article 6 of CIEC, other exemptions and reduced rate taxation are provided for.

Add-on to CO_2 emissions ('carbon tax')

In 2015, under the 'Green Taxation Law'[48] a 'carbon tax' was created (through an add-on to ISP), which applies to the sectors not covered by EU ETS.

This add-on, which was included in CIEC, through the addendum of a new Article 92-A, seeks to promote a low-carbon economy to fight climate change and reduce external energy dependency.

For this purpose, in addition to the rate applicable under ISP, the following products are also subject to the add-on resulting from the application of a tax in accordance with add-ons representing the emission factor of each product, provided that they are subject to ISP and not exempt:

- Petrol;
- Oil and coloured and marked oil;
- Diesel (includes road diesel, coloured and marked diesel and heating diesel);
- LPG (methane and petroleum gases) used as a fuel or propellant;
- Natural gas used as a fuel or propellant;
- Fuel Oil;
- Petroleum coke;
- Coal and coke.

Exemption of a specific product from ISP automatically means that it will not be subject to add-ons relating to CO_2 emissions (Art. 92-A(4)).

In accordance with the calculation formula currently in force as set out in Article 92-A(2) of CIEC, the rate to be applied in each year (n), to which the add-on factor will be applied provided for in Article 92-A(1), is calculated in the preceding year (n-1) as the arithmetic mean of the price resulting from GHG emissions licence auctions, held under EU ETS, from 1 October of year n-2 and 30 September of year n-1.

Add-on factors, the evolution in the carbon tax (CO_2 reference price) and the add-on values by type of fuel are shown in the following table.

[48] Law No 82-D/2014 of 31 December 2014

Figure 55 – Add-on factors, evolution in carbon tax and add-on values by type of fuel

Fuel	Unit	Add-on Factor	2015	2016	2017	2018	2019
Petrol	€/1 000 l	2.271654	11.56	15.15	15.56	15.56	27.87
Oil	€/1 000 l	2.453658	12.49	16.37	16.81	16.81	30.11
Diesel	€/1 000 l	2.4748662	12.60	16.51	16.95	16.95	30.37
LPG	€/1 000 kg	2.9026	14.77	19.36	19.88	19.88	35.61
Natural gas	€/GJ	0.0561	0.29	0.37	0.38	0.38	0.69
Fuel Oil	€/1 000 kg	3.096	15.76	20.65	21.21	21.21	37.99
Petroleum coke	€/1 000 kg	2.6961	13.72	17.98	18.47	18.47	33.08
Coal and coke	€/1 000 kg	2.26567	11.53	15.11	15.52	15.52	27.80
CO_2 reference price	€/t CO_2		**5.09**	**6.67**	**6.85**	**6.85**	**12.27**

Analysis of this tax expenditure with respect to ISP exemptions

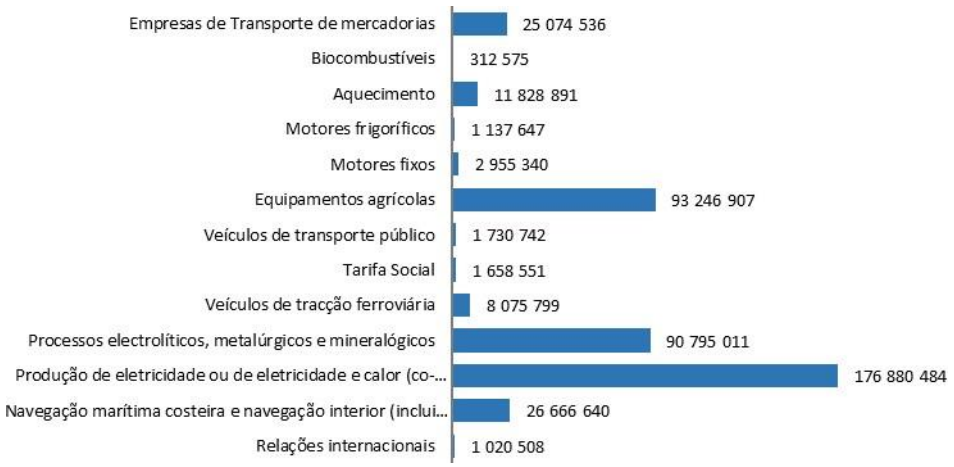
Tax expenditure is a transfer of public resources through reduced tax with respect to normal taxation reflecting the political priorities of a specific country[49]. This advantage conferred to the use of fossil fuels represents a subsidy.

In 2017, tax expenditure relating to the tax on oil and energy products was 441 M€, of which around 256 M€ corresponded to tax expenditure for ISP and around 186 M€ for ISP add-ons, i.e., the carbon tax, due to ISP exemptions.

An analysis of tax expenditure by heading shows that exemptions for the production of electricity have the greatest weighting, with 40%, followed by exemptions conferred to installations covered by EU ETS and by the Energy Intensive Consumption Management System (SGCIE), with 21%.

Exemptions given to agricultural diesel also have an important weighting at 21%. New exemptions relating to professional diesel have a weighting of 6%, which in 2017 had a value of around 25 M€.

Figure 56 – Break down of tax expenditure with regard to tax on oil products (ISP) by heading in 2017 (euros) [Source: Tax Authority]



Key

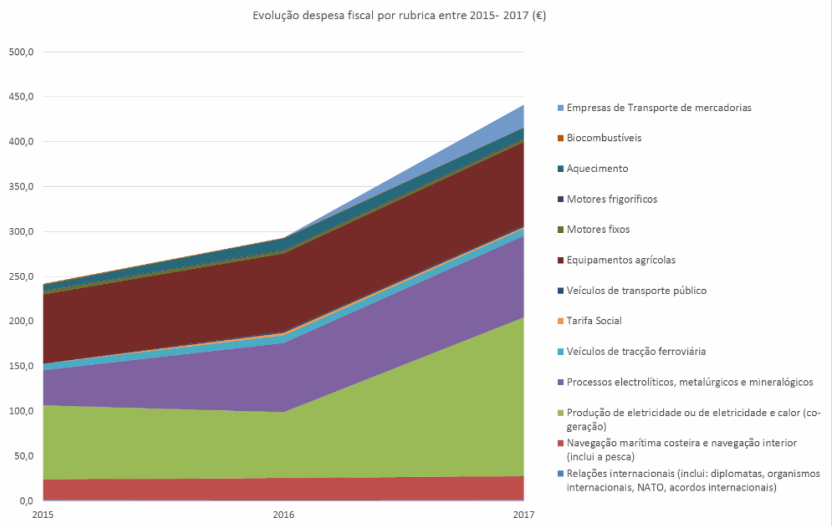
PT	EN
Empresas de transporte e mercadorias	**Transport and goods companies**
Aquecimento	**Heating**
Motores frigoríficos	**Refrigerated engines**
Motores fixos	**Fixed engines**
Equipamentos agrícolas	**Agricultural equipment**
Veículos de transporte público	**Public transport vehicles**
Tarifa Social	**Social tariff**

[49] Tax Benefits in Portugal. Drawn up by the Working Group for the Study of Tax Benefits (2019)

Veículos de tração ferroviária	**Rail stock**
Processos electrolíticos, metalúrgicos e mineralógicos	**Electrolytical, metallurgical and mineralogical processes**
Produção de eletricidade ou de eletricidade e calor (cogeração)	**Production of electricity or electricity and heat (cogeneration)**
Navegação marítima costeira e navegação interior (inclui pesca)	**Coastal maritime navigation and inland navigation**
Relações internacionais	**International relations**

An increase in tax expenditure of 50% was seen from 2016 to 2017, from around 293 M€ to 441 M€. This increase was influenced by a significant rise in expenditure in the heading for electricity production of around 140% relating to EU ELT, and an increase of 18% in SGCIE exemptions, plus the effects of a new exemption for professional diesel for goods transport. The significant increase in the production of electricity from coal, essentially caused by the dry period which led to a reduction in hydro production, was one of the main causes of this rise in tax expenditure.

Figure 57 – Evolution in tax expenditure with regard to tax on oil products (ISP) [Source: Tax Authority]



Key

PT	**EN**
Empresas de transporte e mercadorias	**Transport and goods companies**
Biocombustíveis	**Biofuels**
Aquecimento	**Heating**
Motores frigoríficos	**Refrigerated engines**
Motores fixos	**Fixed engines**
Equipamentos agrícolas	**Agricultural equipment**
Veículos de transporte público	**Public transport vehicles**
Tarifa Social	**Social tariff**
Veículos de tração ferroviária	**Rail stock**
Processos electrolíticos, metalúrgicos e mineralógicos	**Electrolytical, metallurgical and mineralogical processes**
Produção de eletricidade ou de eletricidade e calor (cogeração)	**Production of electricity or electricity and heat (cogeneration)**
Navegação marítima costeira e navegação interior (inclui pesca)	**Coastal maritime navigation and inland navigation (including fishing)**
Relações internacionais (inclui diplomatas, organismos internacionais, NATO, acordos internacionais)	**International relations (includes diplomats, international bodies (NATO), international agreements)**

These exemptions apply to a series of fossil fuels such as coking coal, hard coal, lignite, fuel oil, petroleum coke, natural gas and diesel.

Of note in an analysis of ISP exemptions are those on different fossil fuels. These fossil fuels include those in the following activities which have a higher weighting and relevant growth rates:

- Production of electricity, electricity and heat (co-generation) and city gas by entities producing this gas as their main activity - Article 89(1) of CIEC;
- Electrolytic, metallurgical and mineralogical processes - Article 89(1)(f) and (2)(e) of CIEC:
  - in installations subject to EU ETS;
  - in installations subject to an Agreement to Rationalise Energy Consumption (ARCE).

Exemptions cover (overlap may exist):

- Around 160 installations in sectors for power production, cement, refining, chemical and ceramics covered by EU ETS;
- Around 1 251 entities in the industrial and services sectors covered by ARCEs under SGCIE.

Production of electricity, electricity and heat (co-generation) and city gas.

In 2017, the weighting of tax expenditure for ISP exemptions on fuels used in the production of electricity, electricity and heat (co-generation) and city gas was 40%, around 177 M€. The figure for exemption on carbon tax was 123 M€. Of this sum, 63% corresponds to exemptions for coal and 37% corresponds to exemptions for natural gas.

Figure 58 – Tax expenditure relating to ISP exemptions and carbon tax by type of product associated with the production of electricity in 2017 [Source: Tax Authority]

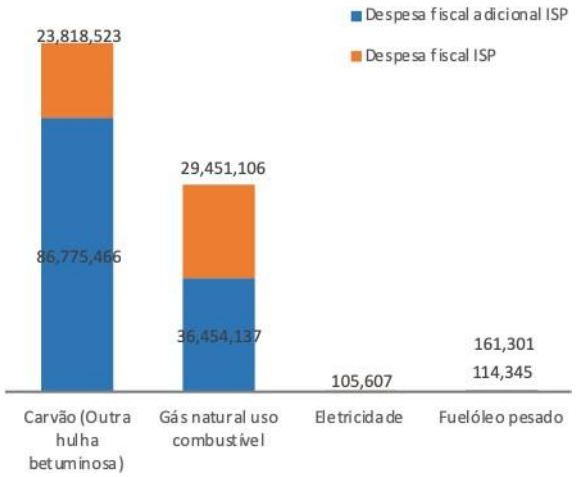
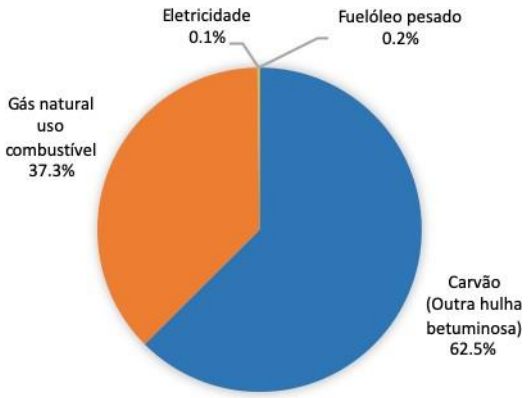


Figure 59 – Breakdown of tax expenditure relating to ISP exemptions by type of product associated with the production of electricity in 2017 [Source: Tax Authority]



Key

PT	EN
Figure 58	
Despesa fiscal adicional ISP	Additional tax expenditure ISP
Despesa fiscal ISP	Tax expenditure ISP
Carvão (Outra hulha betuminosa)	Coal (Other bituminous coal)
Gás natural uso combustível	Natural gas fuel use
Eletricidade	Electricity
Fuelóleo pesado	Heavy fuel oil
Figure 59	
Gás natural uso combustível	Natural gas fuel use
Eletricidade	Electricity
Fuélóleo pesado	Heavy fuel oil
Carvão (Outra hulha betuminosa)	Coal (Other bituminous coal)

Electrolytic, metallurgical and mineralogical processes

In 2017, the weighting of tax expenditure for ISP exemptions on electrolytic, metallurgical and mineralogical processes was 21%, around 91 M€. The figure for exemption on carbon tax was around 44 M€. Of this sum, 68% corresponded to exemptions on natural gas, 26% on electricity and 5% of heavy fuel oil. According to information available to date, 1 294 Agreements to Rationalise Energy Consumption were approved under SGCIE.

Figure 60 – Tax expenditure relating to ISP exemptions and carbon tax by type of product associated with metallurgical and mineralogical processes (EU ETS + the Intensive Energy Consumption Management System - SGCIE - in 2017 (euros)) [Source: TA]

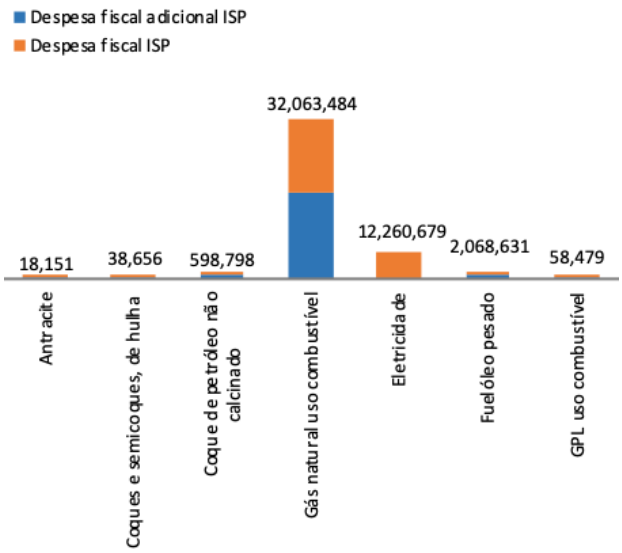
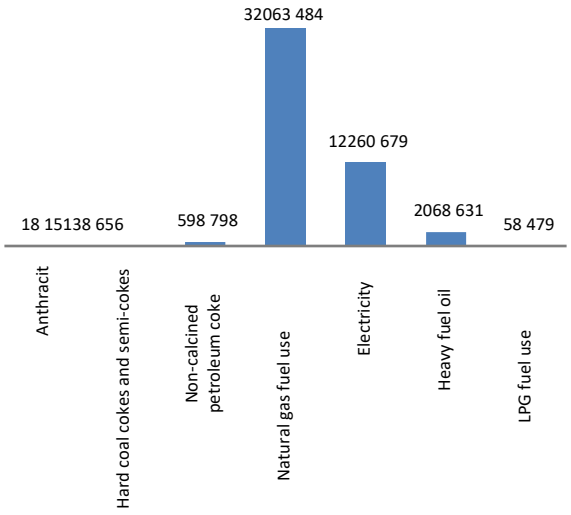


Figure 61 – Breakdown of tax expenditure relating to ISP exemptions by type of product associated with metallurgical and mineralogical processes (EU ETS + SCGIE) in 2017 (euros)

[Source: TA]



Key

PT	EN
Figure 60	
Despesa fiscal adicional ISP	**Additional tax expenditure ISP**
Despesa fiscal ISP	**Tax expenditure ISP**
Antracite	**Anthracite**
Coques e semicoques de hulha	**Hard coal cokes and semi-cokes**
Coque de petróleo não calcinado	**Non-calcined petroleum coke**
Gás natural uso combustível	**Natural gas fuel use**
Eletricidade	**Electricity**
Fuélóleo pesado	**Heavy fuel oil**
GPL uso combustível	**LPG fuel use**

Taxes and levies with environmental relevance

According to the National Statistics Institute (INE), in 2018 the value of taxes with environmental relevance[50] stood at approximately 5.3 billion euros, corresponding to 7.4% of total tax income and social contributions (7.6% in 2017). This figure represented an increase of 4.3% over 2017, as compared to the variation of 6.4% seen for total tax income and social contributions.

From 2017 to 2018, the tax on oil and energy products lost importance in relation to taxes with environmental relevance (fell from 69.2% to 67.3%). In contrast, the car circulation tax gained importance now standing at 12.3% of all taxes with environmental relevance, as did other taxes on energy which include GHG emissions licences, which increased 111.2%.

Figure 62 – Evolution in taxes with environmental relevance [Source: INE]

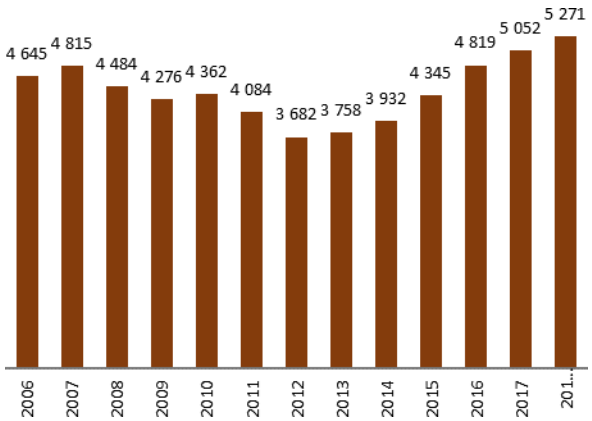
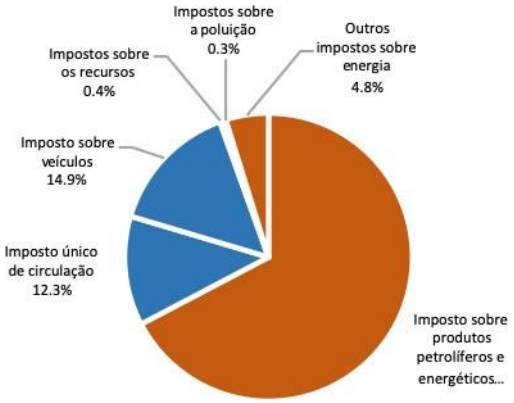


Figure 63 – Taxes with environmental relevance by category in 2018 [Source: INE]



Key

PT	EN
Figure 63	
Imposto único de circulação	**Road tax**
Imposto sobre veículos	**Vehicle tax**
Imposto sobre os recursos	**Resource tax**
Imposto sobre a poluição	**Pollution tax**
Outros impostos sobre energia	**Other taxation on energy**
Imposto sobre produtos petrolíferos e energéticos	**Tax on oil and energy products**

According to information available for 2017, the weighting of these taxes in total tax Income, including social contributions, was greater in Portugal (7.6%) when compared to the EU average (6.1%). In the same year, the weighting of taxes with environmental relevance in GDP in Portugal (2.6%) was greater than the UE28 average (2.4%).

[50] In 'tax with environmental relevance' income is identified as obtained by authorities through taxation of products and services, the tax base for which may have a negative impact on the environment. As such, all taxes on such taxation bases are taxes with environmental relevance

Included in these taxes are taxes on energy, transport, pollution and taxes on resources. However, of note is the significance of three taxes: the tax on oil and energy products, the vehicle tax and the car circulation tax, which in 2018 constituted 90% of taxes with environmental relevance.

In 2017, the last year for which information is available, levies with environmental relevance[51], stood at 1.484 billion euros (0.8% of GDP), an increase of 4.7% over figures for 2016. This is mainly a reflection of the increase in levies on health security and sanitation (+5.3%), waste management (+130.5%) and on the management of the recycling system for glass, paper, plastic, metal and wood (+29.8%).

By category, in 2018, taxes on energy represented 72.1% of total tax income with environmental relevance. Tax on transport had weighting of 27.2%. Tax on resources and on pollution were of minimal weighting in the structure of taxes with environmental relevance (0.4% and 0.3%, respectively).

[51] A levy differs from a tax in that authorities use the income earned to establish some type of regulatory function (such as verifying the competences or qualifications of the entities involved or establishing management systems in different areas which tend, through their activity, to cause negative impacts on society).

5. IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES

5.1. Impacts of planned policies and measures on the energy system and on GHG emissions and removals, including comparison with projections based on existing policies and measures

i. Projections of the evolution of the energy system and GHG emissions and removals as well as, where relevant of emissions of air pollutants in accordance with Directive (UE) 2016/2284 under the planned policies and measures

With respect to projections for total primary energy consumption for the 2030 horizon, it is expectable that, given the policies and measures planned for implementation in the 2020-2030 period, particularly the focus on renewable energies and the decommissioning of coal-fired plants, consumption of energy will continue on a downward trend which could lead to aagr of between -0.5% and -2.3%.

As a result of the decommissioning of the two coal-fired plants, this source of energy will no longer feature in the mix of primary energy consumption, contributing significantly to a reduction in the energy bill. In 2030, renewables will have the largest weighting in the energy mix, standing at more than 40%, almost double the weighting of 2015. The weighting of natural gas will remain practically unchanged in the coming decade, and oil products will drop below 40% in the weighting.

Figure 60 - Estimated evolution in primary energy consumption for the 2030 horizon (ktoe)

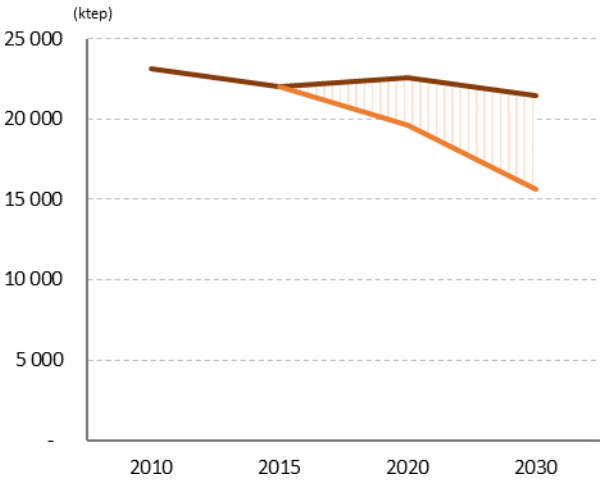
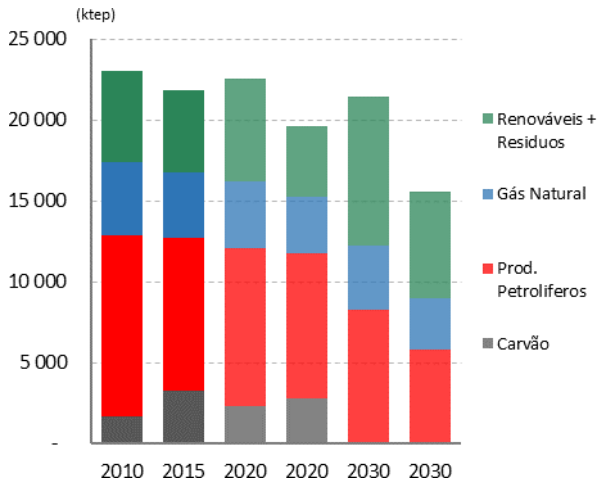


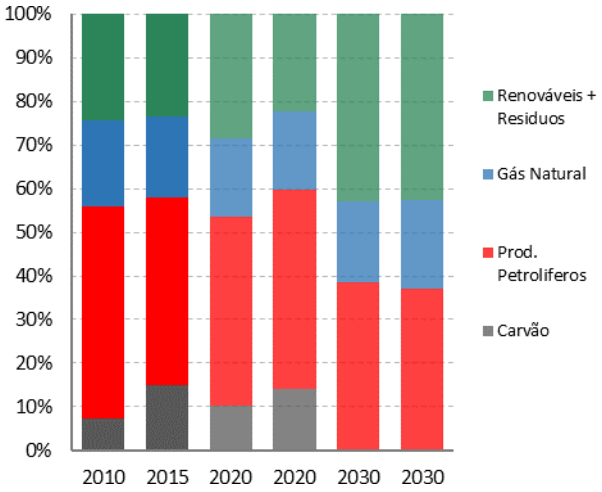
Figure 61 - Estimated evolution in primary energy consumption by type of source for the 2030 horizon (ktoe)



Key

PT	EN
Figure 61	
Renováveis + Resíduos	Renewables + waste
Gás natural	Natural gas
Produtos Petrolíferos	Oil products
Carvão	Coal

Figure 62 – Estimated evolution in primary energy consumption by type of source for the 2030 horizon



Key

PT	EN
Figure 61	
Renováveis + Resíduos	**Renewables + waste**
Gás natural	**Natural gas**
Produtos Petrolíferos	**Oil products**
Carvão	**Coal**

With respect to projections for total final energy consumption for the 2030 horizon, it is expectable that, given the policies and measures planned for implementation in the 2020-2030 period, particularly the focus on energy efficiency and electrification, consumption of energy will continue on a downward trend which could lead to aagr of between -0.4% and -0.8%.

Electricity is gaining increasing relevance in the mix of final energy consumption. Projections show that the weighting of electricity in total consumption will be above 30% by 2030, meaning that it will be the main energy used in 2030. Biomass and natural gas will gain further expression by 2030 and hydrogen will appear as a new energy source, while the consumption of heat will remain stable in coming years. On an opposite trajectory will be oil products which will see their weighting in the energy mix reduce in the next decade between 13 p.p. and 20 p.p. over figures for 2015. These changes will depend greatly on the speed of the electrification of the economy and the penetration of renewable gases such as hydrogen.

It is important to mention that the growing importance given to renewable gases, particularly hydrogen, does not have any direct influence of the scenarios presented. The potential of such renewable gases in Portugal requires a more in-depth analysis, which will take place in 2020-2021 and appear in the NECP review to take place in 2023, for submission to the Commission at the end of 2024.

Figure 63 - Estimated evolution in final energy consumption for the 2030 horizon (ktoe)

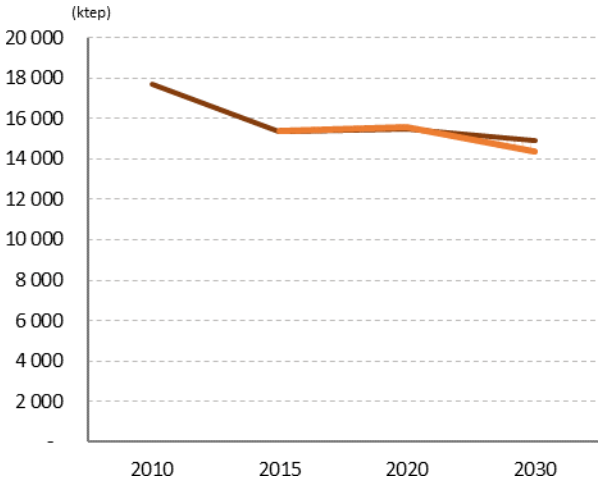


Figure 64 - Estimated evolution in final energy consumption by type of source for the 2030 horizon (ktoe)

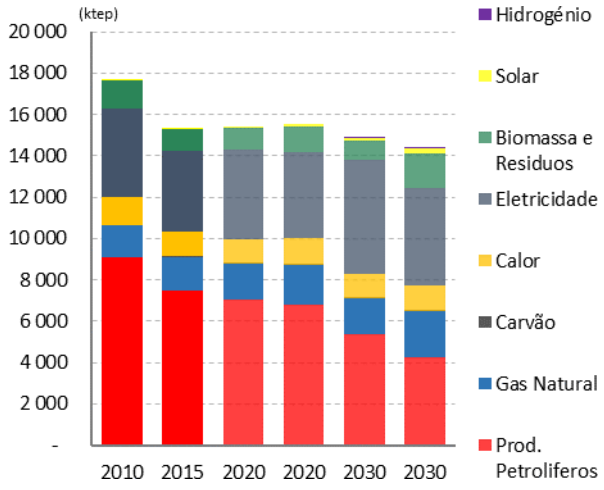
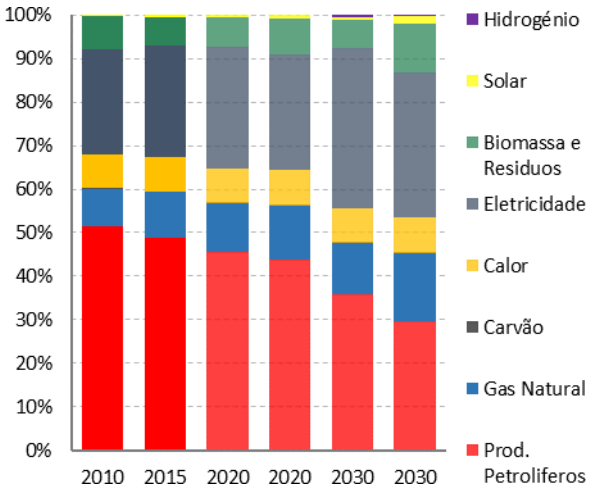


Figure 65 – Estimated evolution in final energy consumption by type of source for the 2030 horizon



Key

PT	EN
Figures 64 and 65	
Hidrogénio	**Hydrogen**
Solar	**Solar**
Biomassa e Resíduos	**Biomass and Waste**
Eletricidade	**Electricity**
Calor	**Heat**
Carvão	**Coal**
Gás natural	**Natural gas**
Prod. Petrolíferos	**Oil products**

As part of work under RCN2050, projections were made for the activity trajectories and the respective GHG emissions of the corresponding sectors, the energy system (including the production, transmission and consumption of energy sectors), agriculture, forestry and other land uses and waste and wastewater. This exercise further included an equally detailed assessment for 2030 and 2040 which allowed new emissions trajectories to be delineated compatible with the national objective to achieve carbon neutrality by 2050.

A new development in relation to similar exercises conducted in the past is the fact that some of the expectable climate changes for the horizon 2050 were included in the modelling. These changes included alterations in the efficiency of technologies, demand for services and the availability of resources (such as a reduction in hydro availability or an increase in cooling requirements).

Results from these projections have allowed potential national emission reduction to be reanalysed, confirming the technical and economic viability of pursuing a low-carbon trajectory for 2020/2030, on the road to carbon neutrality in 2050.

A sector analysis of emissions trajectories confirms that all sectors have significant potential to reduce GHG emissions, although the speeds of reduction may differ.

Analysis of the behaviour of the different sectors in the conditions established for the existing policies scenario, as well as for the additional policies (or neutrality scenarios) helps identify key factors, trends and behaviours for the same timeframe considered.

The methodologies used to estimate GHG emissions is that set out in the National Inventory Report (NIR). A specific projection methodology for the respective activity variables was adopted for each of the sectors of activity. However, it was based on the same socio-economic framework to ensure consistency in the projections obtained. It should be further noted that, for the purposes of the projections presented in the existing policies scenario, the policies and measures instruments approved and published up to 31 December 2017 were taken into account, as were a number of commitments undertaken by Portugal, such as the termination of power production from coal. Shown below is a results summary of modelling carried out on GHG emissions per sector for the 2030 and 2040 horizons, in existing and additional policies scenarios.

Table 40- Projection of GHG Emissions per sector (kt CO2eq)

			EXISTING POLICIES SCENARIO	
	2005	**2020**	**2030**	**2040**
1. Energy	63 958	45 035	27 260	21 136
Production of electricity	23 057	12 942	1 616	662
Refining	2 466	2 220	2 129	1 802
Fugitive emissions	669	1 202	1 157	1 090
Industry	10 565	7 646	6 222	5 791
Transport	19 821	16 272	11 699	7 883
Services	3 164	1 178	1 203	860
Residential	2 695	2 427	2 079	1 963
Agriculture, forestry and fisheries	1 447	1 163	1 158	1 090
2. Industrial Processes and Use of Products	8 419	7 043	5 157	4 416
Industrial processes	7 339	4 817	4 289	3 900
F-gases	1 080	2 226	868	516
3. Agriculture	6 770	6 791	6 566	6 648
4. LULUCF	1 520	-3 778	-8 082	-9 310
Forest land	-2 224	-8 673	-12 697	-14 029
Agricultural land	1 361	802	623	607
Pasture	1 701	128	416	504
Other land	647	3 964	3 576	3 608
5. Waste and Wastewater	6 463	4 405	3 317	2 358
Total without LULUCF	**85 610**	**63 274**	**42 303**	**34 562**
Total with LULUCF	**87130**	**59 496**	**34 221**	**25 252**

Existing Policies Scenario (WEM)

As can be seen, even in a scenario of existing policies, a sharp reduction in GHG emissions is expected in coming

decades, and cost-effective potential exists for Portugal to reduce total emissions by 2030 of around 51% in relation to 2005. This figure will rise to 60% by 2040 (without LULUCF).

In 2030, this reduction will be largely the result of the closure of coal-fired power plants and focus on the role of renewable energies in the national energy mix, particularly solar. By 2030, the electricity production sector has the potential to reduce GHG emissions by around 93% with respect to 2005 (and around a 97% reduction by 2040).

The transport and mobility sector is also expected to see far-reaching changes with much increased use of electric vehicles and potential emissions reduction of around 41% by 2030 with respect to 2005 and around 60% by 2040.

The services and wastes sectors also have solid potential to reduce GHG emissions, contributing with 62% and 49%, respectively by 2030 (and 73% and 64%, respectively, by 2040). This will be due to increased energy efficiency and compliance with the Landfill Directive restricting deposits to just 10% by 2035. In relation to the waste sector, the existing policies scenario already assumes compliance with the target set out in the Landfill Directive, and as such, the projections for this sector are identical in both in the existing policies as well as in the additional policies scenarios.

In the same timeframe, the residential, industrial and agriculture sectors have lower decarbonisation potential. Even so, the residential sector could contribute with a reduction of 23% by 2030 (around 27% by 2040) and the industrial sector with 42% (around 47% in 2040). For the agricultural sector, figures show a reduction of 3% by 2030. Taking into account the effect of agricultural land and pasture, reductions could reach 22% by this time.

With regard to F-gases, the relevance of which terms of emissions has increased in recent years, reductions are expected of around 20% by 2030 and 52% by 2040. As was the case in the waste sector, compliance with the targets set out in the Kigali Amendment are also assumed in the F-gases sector, and as such, the projections for this sector are identical in both in the existing policies as well as in the additional policies scenarios.

However, additional policy measures need to be considered for the majority of sectors, so as to achieve a more ambitious low-carbon trajectory allowing carbon neutrality to be reached by 2050.

Additional Policies Scenario (WAM)

With respect to the Additional Policies Scenario (or neutrality scenario), unlike the previous scenario, restrictions are imposed on emissions to achieve carbon neutrality by 2050. This scenario thus allows the additional effort required by each sector to be assessed, so that overall neutrality is achieved, not exactly reflecting a typical scenario of assessing the impact of planned policies and measures.

It can also be seen that cost-effective potential exists to reduce GHG emissions more quickly with respect to the existing policies scenario, around 55% in relation to 2005, with this figure rising to 73% by 2040 (without LULUCF). decarbonising almost all electricity production and drastically reducing emissions from mobility and transport and buildings in the coming two decades (2020-2040).

As such, in an additional policies scenario, in 2030 the electricity production would present potential GHG emissions reduction of around 95% over 2005, the transport sector around 46% and the buildings sector 48%. By 2040, these figures would stand at 98%, 84% and 82%, respectively.

With respect to industry, reductions of around 47% are expected by 2030 and 59% by 2040, due to the expected improvements in the efficiency of processes and the use of less polluting fuels, with the incorporation of more RDF, biomass and the electrification of a number of sub-sectors.

In an additional policies scenario, the agricultural sector could contribute to emissions reduction of around 6% by 2030. Taking into account the effect of agricultural land and pasture, reductions could reach 36% by the same date.

With respect to waste and F-gases, and in light of the commitments to comply with the targets set out in the Landfill Directive and the Kigali Amendment, respectfully, it can be seen that evolution is similar to the existing policies scenario.

In this regard, the role of the forest sink and other soil uses must be reinforced. Efficient agro-forestry management is a determining factor if the objective of carbon neutrality is to be achieved by 2050.

Table 41- Potential GHG emissions reduction with respect to 2005 (%)

	EXISTING POLICIES SCENARIO		**ADDITIONAL POLICIES SCENARIO**	
	2030	**2040**	**2030**	**2040**
1. Hydro	-57%.	-67%.	-62%.	-84%.
Production of electricity	-93%.	-97%.	-95%.	-98%.
Refining	-14%.	-27%.	-24%.	-69%.
Fugitive emissions	73%.	63%.	54%.	-34%.
Industry	-41%.	-45%.	-51%.	-67%.
Transport	-41%.	-60%.	-46%.	-84%.
Services	-62%.	-73%.	-66%.	-90%.
Residential	-23%.	-27%.	-26%.	-73%.
Agriculture, forestry and fisheries	-20%.	-25%.	-23%.	-25%.
2. Industrial Processes and Use of Products	-39%.	-48%.	-39%.	-48%.
Industrial processes	-42%.	-47%.	-42%.	-47%.
F-gases	-20%.	-52%.	-20%.	-52%.
3. Agriculture	-3%.	-2%.	-6%.	-7%.
5. Waste and Wastewater	-49%.	-64%.	-49%.	-64%.
Total without LULUCF	**-51%.**	**-60%.**	**-55%.**	**-73%.**

This neutrality scenario also served to inform on the new targets to reduce the GHG emissions defined for 2030, 2040 and 2050, dropping by -45% to -55% by 2030, -65% to -75% by 2040, and -85% to -90% by 2050 over figures for 2005, as already mentioned.

Results obtained show that significant levels of renewable energies in final energy consumption could be achieved, reaching 85-90% in 2050, particularly in electricity production and transport which could achieve full electrification in 2050 (road and rail sectors). There would also be a significant increase in the efficiency of the economy, resulting in a reduction in primary energy consumption of 40% by 2050 and a significant reduction in the energy intensity of the economy

ii. Assessment of policy interactions (between existing policies and measures and planned policies and measures within a strategic policy dimension and between existing policies and measures and planned policies and measures of different dimensions) 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 and savings policies on the sizing of the energy system and to reduce the risk of stranded investment in energy supply

Not applicable.

iii. Assessment of interactions between existing policies and measures and planned policies and measures, and between those policies and measures and Union climate and energy policy measures

Resilience and capacity to adapt to climate change

The special report from the Intergovernmental Panel for Climate Change on the impact of global warming of 1.5℃ shows that ensuring this maximum ceiling on the mean global temperature increase will have as a practical consequence a significant reduction in associated risks and impacts.

According to the majority of studies, countries in southern Europe have greater vulnerabilities and less opportunities as a result of climate change when compared to other sub-regions of the European continent. They will also suffer more deaths caused by heat, water restrictions, loss of habitats, energy needs for cooling and rural fires. This is exemplified in the PESETA II[52] project which demonstrated that the economic losses associated with climate change are distributed in a highly asymmetrical manner, with a clear bias towards the regions of southern Europe. In a scenario where the mean temperature rise is 2°C before the end of the century, this study concludes that losses in well-being in terms of GDP would vary from 0.2% in northern Europe to 3% in southern Europe, in the last third of this century.

In recent years, the negative effects of climate change have been seen in Portugal, with extreme weather events occurring with greater intensity and frequency, as has been the case with major storms, frequent droughts, large-scale rural fires, heat waves and the worsening of coastal erosion.

To adapt in an integrated manner to these effects and prepare the country for possible more serious future scenarios, Portugal has had a National Adaptation Strategy in place since 2010 (ENAAC), built on a solid scientific base and which was reviewed in 2015 (ENAAC 2020). This strategy focuses essentially on improving coordination between areas, particularly those of a transversal nature, on the integration of sector policies and on implementing adaptation measures.

Recognising that the impacts of climate change have a strong territorial component means that adaptation must be implemented by local agents. This was one of the central aspects which led to the creation of the AdaPT Programme. Financed by EEA Grants and the Environmental Fund, it was an important milestone in the national adaptation process, bringing about structural projects such as Climadapt.local, originating 27 municipal adaptation strategies and the Climate Portal, an information base providing climate scenarios for Portugal. This programme was the driver for many other projects funded by national and European financing instruments, on both a municipal as well as intermunicipal level, such as the conclusion of adaptation measures, particularly in coastal protection, the efficient use of water, rural fire prevention and the preservation of nature. Currently, the majority of Portuguese territory is covered by more than 50 municipal and intermunicipal adaptation plans.

With a view to emphasising the implementation of adaptation measures, mobilising different current financing instruments and defining the framework of future instruments, in 2019, the Action Programme for Adaptation to Climate Change was implemented (P-3AC), for 2030. This programme defines priority areas of intervention in

[52] Available at: http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=7181

response to the main vulnerabilities and impacts of climate changes identified for national territory:

- Increase in the frequency and intensity of rural fires;
- Increase in the frequency and intensity of heat waves;
- Increase in the frequency and intensity of periods of drought and water shortages;
- Increase in susceptibility to desertification;
- Increase in the maximum temperature;
- Increase in the frequency and intensity of extreme rain events;
- Rise in seawater levels;
- Increase in the frequency and intensity of extreme phenomena causing sea wall breaches and coastal erosion.

To counteract such impacts and the vulnerabilities of national territory, a series of interventions with direct impact on the territory was set out in eight action lines plus one line for support instruments. The activities involved were also described along with the respective monitoring indicators and potential sources of funding. The action lines were organised as follows:

1. Prevention of rural fires - structural interventions in agricultural and forestry areas;
2. Implementation of conservation techniques and improvement of soil fertility;
3. Implementation of good practices for water management in agriculture, industry and on an urban level to prevent impacts arising from drought and water shortages;
4. Increase the resilience of ecosystems, species and habitats to the effects of climate change;
5. Reduce the vulnerability of urban areas to heat waves and the increase in the maximum temperature;
6. Prevention of the planting and expansion of invasive exotic species with vector transmitted diseases and agricultural and forestry diseases and pests;
7. Reduce or minimise the risks associated with flooding;
8. Increase coastal resilience and protection in areas presenting high risks of erosion, sea wall breaches and flooding;
9. Development of decision support tools and empowerment and awareness actions.

The total amount of funding granted in recent years under this programme was 762 M€ for measures relating to adaptation and 372 M€ was identified for use up to the end of the current Community programme. An increase in these amounts is expected for the future programme up to 2030, depending on the results of negotiations underway on the multi-annual financial framework.

With a view to meeting the challenge of monitoring the effectiveness of the adaptation measures in Portugal, P-3AC instigated quantified targets for a vast range of indicators.

In light of this scenario, in 2019 the Action Programme for Adaptation to Climate Change (P-3AC) was implemented, for 2030, which defines the priority areas of intervention in response to the main vulnerabilities and impacts of climate changes identified for national territory.

It is further important to note as relevant under this Programme, that there are a number of decarbonisation measures and options which have evident synergies with adaptation to the effects of climate change. These include, measures which contribute to carbon capture by forests and agriculture (increasing organic material in soils and their capacity to retain water, combating desertification), natural base solutions (installation of green roofs and other green infrastructure in urban areas, rewilding of waterproofed areas, etc.). There are also measures to improve energy efficiency which have already helped reduce total energy consumption and thus lessen the vulnerability of the energy system to pressures arising from extreme events.

Furthermore, the impacts of climate change must be taken into consideration in mitigation options, more specifically with regard to future hydro availability, heating and cooling requirements and rural fire risks.

Renewable energy projections thus take into account the falling availability of water to produce electricity, which is expectable in the RCP 4.5. climate scenario now considered as probable. It is estimated that hydro production will, on average, suffer a reduction of 9% by 2050 over figures for 2020, considering a hydraulicity index of 0.8.

The greatest needs for cooling were also taken into account in energy demand scenarios, particularly in the residential and services sectors.

In this regard, it is particularly important to note that the determining factor in the forest's capacity to act as a carbon sink - reduction in the average annual area consumed by fire - will be hindered in a scenario where the effects of climate change worsen.

It is therefore, undeniable that the implementation of adaptation measures is one of the critical factors in decarbonisation objectives, both with regard to the reduction of emissions as well as sequestration capacity. Similarly, carbon neutrality is one of the guarantees of adaptation capacity, as achieving this aim will only be possible if the levels of CO_2 in the atmosphere do not exceed a specific threshold, after which adaptation will no longer be possible and society as we know it will cease to exist. The synergies for mitigation and adaptation which can be seen in a range of measures are a further sign that integrated action is required between both these aspects in all components of society.

Role of the Circular Economy

The role of the Circular Economy is vital, it is a basic and structural argument in transition and will provide the foundation for the decarbonisation of the Portuguese economy. It has thus been considered an integral part of the narrative in the socio-economic scenarios developed and was reflected in the assumptions for different sectors on which GHG modelling was based.

The role of the Circular Economy has been subject to intense scrutiny within the value chain of a series of sectors considered as important for the success of the aims of this Plan and the aim to achieve carbon neutrality by 2050. Relevant impact from circularity is foreseen for these sectors – the mobility sector, the agri-food sector, forestry, construction and waste.

The potential effects of circular strategies were assessed, for example, in energy consumption, the production of waste and in carbon retention, and modelling variables (sector based) of emissions impacted were identified.

In the mobility sector, the transitions created in the circular economy point to less use of individual transport and growth in shared and multimodal mobility services (both in relation to public transport as well as private transport) and an increase in the car occupancy rate.

New business models appear which replace the supply of goods (vehicles) with the provision of services and ownership through use.

Moreover, the increased interconnectivity of supply chains (more on-line shopping, more reverse logistics) also increases the demand for the mobility of goods, also increasing the pressure on this sector. Similarly, it will be necessary to increase the load capacity of heavy and light goods vehicles, fleet autonomy and the technological replacement rate of such fleets so as to obtain improvements in the efficiency of vehicles (passenger, and heavy and light goods). This approach will allow more competitive business models, with lower operating costs and less GHG emissions.

Such changes do not have much impact within the timeline of this plan, but effects start to be seen as of 2040.

In the agri-food sector, the implementation of regenerative and more efficient agricultural practices in the use of resources such as water and power, and new eating habits and lifestyles help reduce waste and the respective organic fraction (by reducing food waste), thus also allowing emissions to be reduced.

The expansion of biological agriculture, conservation and precision agriculture, along with permanent pastures, will allow a reduction in emissions from the use of synthetic fertilizers and animal effluents. It will also increase carbon sequestration as a result of increases in the organic matter content of soils (the use of compost to replace synthetic nitrogen fertilizers is a circular measure).

These circular strategies will lead to a reduction in GHG emissions in the agricultural sector of around 11% by 2030.

Similarly, an increase in forestation, promotion of more efficient forestry practices in the use of resources and in risk management and improvement of ecosystem services will lead to a growing role for the bioeconomy impacting on carbon retention and the net balance of emissions. Productivity gains in the future may come from the use of best practices in forest management and less losses through fires.

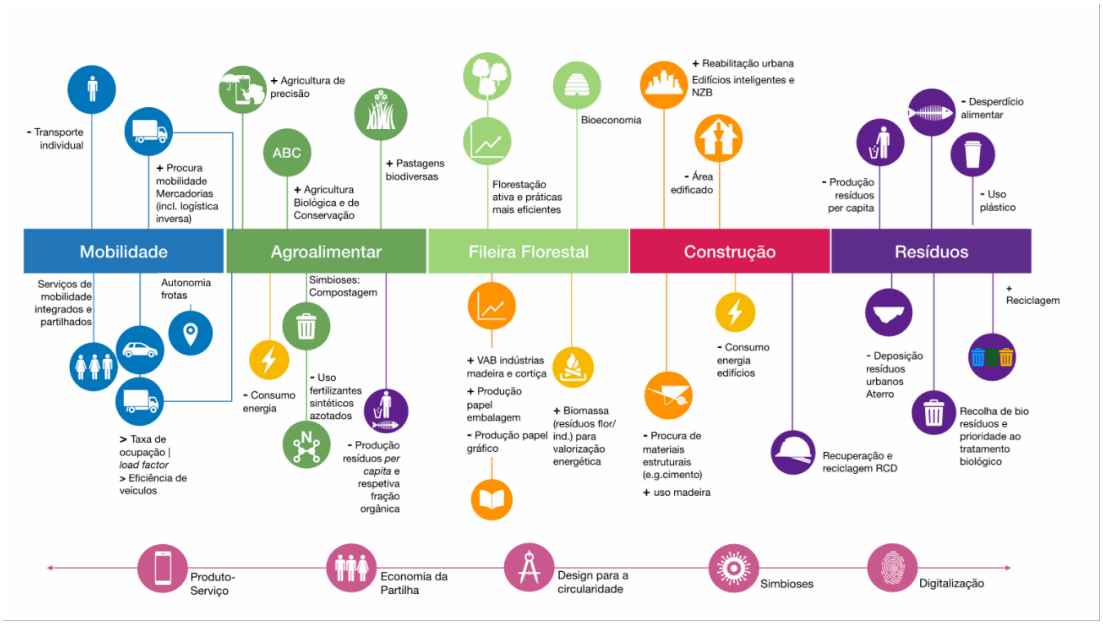
Forestry is a value chain which even today has a high degree of circularity, and forests play an undeniable role in decarbonisation. As such, it can be seen that investment in forestry to increase biological carbon sequestration could lead to gains of more than 40% by 2050 (when compared to a non-circular scenario).

In construction, circular strategies to be followed include an increase in urban rehabilitation and the reuse of building components, recovered and recycled materials, and the use of public spaces built ‘as open’, NZEB buildings, multi-function and shared buildings with the corresponding reduction in constructed area, along with the use of new, more sophisticated materials offering greater energy efficiency and durability, and renewable materials with a smaller carbon footprint (e.g. Wood and cork). These circular economy strategies could lead to a reduction in GHG emissions in the residential sector of around -4% by 2040.

Circularity strategies for waste, which have always been closely linked to this sector, will allow a reduction in the amount of waste per capita and the respective organic fraction, particularly by reducing food waste and the use of plastics. An increase in the selective collection of bio-waste is also expected along with an increase in the selective collection of multi-material and the development of recycling chains. The depositing of urban waste in landfills is also expected to be minimised.

It can thus be seen that the circular economy can lead to significant reductions in the GHG emissions associated with waste management (including the use of urban waste for generating power) of up to 69% by 2050.

Figure 64 - Transitions brought about by the circular economy (Source: RCN2050)



Key

PT	EN
Mobilidade	Mobility
- Transporte individual	- Individual transport
+ Procura mobilidade Mercadorias (incluindo logística inversa)	+ Demand mobility Goods (including reverse logistics)
Serviços de mobilidade integrados e partilhados	Integrated and shared mobility services
> Taxa de ocupação | load factor	> Occupancy rate | load factor
> Eficiência de veículos	> Vehicle efficiency
> Autonomia de frotas	> Fleet autonomy
Agroalimentar	Agri-food
+ Agricultura de precisão	+ Precision agriculture
+ Agricultura Biológica e de Conservação	+ Biological and conservation agriculture
+ Pastagens biodiversas	+ Bio-diverse pasture
- Consumo de energia	- Energy consumption
Simbioses: Compostagem	Symbioses: Composting
- Uso de fertilizantes sintéticos azotados	- Use of synthetic nitrogen fertilisers
- Produção de resíduos per capita e respetiva fração orgância	- Production of waste per capita and respective organic fraction
Fileira florestal	Forestry
Florestação ativa e práticas mais eficientes	Active foresting and more efficient practices
Bioeconomia	Bioeconomy
+ VAB indústrias madeira e cortiça	+ GAV wood and cork industries
+ Produção de papel embalagem	+ Production of packaging paper
- Produção de papel gráfico	- Production of graph paper
+ Biomassa (resíduos flor/ind.) para valorização energética	+ Biomass (waste for/ind.) for energy use
Construção	Construction
+ Reabilitação urbana, edifícios inteligentes e NZB	+ Urban rehabilitation, smart and NZEB
- Área edificada	- Built area
+ Procura de materiais estruturais (e.g. cimento)	+ Demand for structural materials (e.g. cement)
+ uso de madeira	+ use of wood
- Consumo de energia edifícios	- Consumption of energy buildings
Recuperação e reciclagem RCD	Recovery and recycling RCD
Resíduos	Waste
- Produção de resíduos per capita	- Production of waste per capita
- Desperdício alimentar	- Food waste
- Uso de plástico	- Use of plastic
- Deposição de resíduos urbanos Aterro	- Depositing of urban waste Landfill
Recolha de bio resíduos e prioridade ao tratamento biológico	Collection of bio waste and prioritise biological treatment
+ Reciclagem	+ Recycling
Produto-serviço	Product-service
Economia da partilha	Sharing economy
Design para a circularidade	Design for circularity
Simbioses	Symbioses
Digitalização	Digitalisation

5.2. Macroeconomic impacts and, as far as it is viable, on health, the environment, employment, education, social competences and impacts, including transitory aspects[53]

With respect to opportunities, it is undeniable that there will be a positive effect on GDP and employment. Even within an extremely conservative scenario, the macro-economic analysis conducted under NECP 2030 and RCN2050 points to a positive overall impact on GDP as a result of the almost total decarbonisation of the national energy system. This will lead to significant growth in investment and private consumption and a net gain, although marginal, in jobs. There will also be exceptional opportunities for new business models to appear and the creation of new clusters with the potential for net generation of employment, more specifically in the:

- Production of renewable energies; storage and battery technologies; smart networks;
- The electric vehicle value chain (including production, batteries, charging network; logistics and services connected to shared and autonomous mobility);
- Value chain of the hydrogen economy and other renewable gases;
- Urban rehabilitation and technologies associated with the improvement of thermal comfort in buildings;
- Automation engineering;
- Value chain in agricultural production, including new technologies and precision agriculture;
- Research, innovation and development associated with all areas of decarbonisation and energy transition;

This new vision will further drive the acquisition of new competences and lead to the need for requalification and training in the sectors and activities impacted most, particularly those connected to fossil fuels. It will therefore be necessary to programme a series of actions to create the conditions and skills necessary for fair transition.

[53] (With regard to the costs and benefits and cost-effectiveness ratio) of the planned policies and measures described in Section 3, at least until the last year of the period covered by the plan, including a comparison with projections based on existing policies and measures.

It should also be noted that estimates do not include quantified impacts with respect to the co-benefits obtained through the damage avoided, for example, in relation to health and biodiversity, or the respective costs of adapting to climate change.

Co-benefits of decarbonisation and energy transition for the quality of air and public health

Many processes which emit GHG are also responsible for the emission of other atmospheric pollutants which cause environmental problems such as deterioration in the quality of air, acidification and eutrophication, resulting in damage to ecosystems and the subsequent loss of biodiversity and problems affecting human health, particularly respiratory and cardiovascular problems. Air pollution also has considerable economic impact, reducing average life expectancy, increasing medical costs and reducing productivity impacting on all areas of the economy.

Air pollution is today identified as one of the greatest environmental risks to health. The World Health Organization has identified particulate matter (PM), Nitrogen oxides (NO and NO_2), sulphur dioxide (SO_2) and atmospheric ozone (O_3) as the most harmful air pollutants. Unlike other pollutants, ozone is not emitted directly, but is a pollutant which forms in the atmosphere in the presence of other pollutants, such as Nitrogen oxides.

Particulate matter has numerous origins but comes mainly from the burning of fossil fuels and biomass and is the most harmful group of pollutants to health. The smaller these particulates are, the greater the probability is that they will penetrate deep into the respiratory system and a greater risk exists that they will induce negative effects on health. Smaller, inhalable particulates (PM10 and PM2.5) reach the lungs and finer PM2.5 particulates even enter the bloodstream.

Sulphur oxides do not currently represent a serious problem to air quality due to numerous measures already taken, such as requirements to reduce the sulphur content in fossil fuels.

Furthermore, Nitrogen oxides come mainly from road traffic, and in large cities, they are primarily responsible for poor air quality. The implementation of measures spatial planning and road traffic management may thus minimise the impacts of these pollutants.

When climate change affects weather conditions, such as through the frequency of heat waves and long atmospheric stability, the periods in which ozone levels are high tend to be prolonged, and can contribute to an increase in the concentration of suspended particulates, leading to a deterioration in air quality and increased risk of diseases associated with air pollution.

In 2018, Portugal saw an increase of 3.3% over the previous year in days where the air quality index was ‘very good’ or ‘good’ and a fall of 1.2% in days with a classification of ‘poor’ and ‘bad’, indicating an improvement in air quality.

An analysis of the 2002 to 2018 period shows that there is a downward trend in the percentage of days classified as ‘poor’ or ‘bad’, having fallen from around 17% in 2005 to 1% in 2018.

Despite the improvement seen in recent years, air quality problems persist in Portugal in some locations, mainly in densely populated urban areas where concentrations of a number of air pollutants frequently exceed limits, such as those for nitrogen dioxide (NO_2) and suspended particulates (PM10). There are also areas where values greater than those set for long-term ozone levels are frequently seen.

Estimates on the impact on human health attributable to ling-term exposure to air pollution[54] indicate that concentrations of PM2.5 in 2016 were responsible for 412 000 premature deaths in Europe, of which 374 000 occurred in EU-28. In 2016, it was estimated that exposure to concentrations of NO2 and O3 among the European population caused around 71 000 and 15 100 premature deaths per year, respectively. Figures for the EU-28 were around 68 000 and 14 000, respectively. It is also estimated that there are around 6 000 premature deaths per year in Portugal due to exposure to air pollution caused by these three pollutants.

Although GHG do not have a direct effect on human health or ecosystems, it is expected that the policies to reduce them will also contribute to a reduction in air pollutants as such pollutants have the same origins.

Decarbonisation strategies will impact on economic activities and consequently on the generating of air pollutant emissions. It is therefore expectable that the planned energy transition and the goal for carbon neutrality will provide co-benefits to improve air quality, with positive effects on human health, particularly with regard to respiratory diseases.

This effect will be especially relevant in cities due to the transformation planned for mobility, with the reinforcing of public transport and intermodality, the decarbonisation of fleets through zero or low-emission technologies and the increase in active and shared mobility.

Positive impacts can also be expected in relation to ecosystems, where air pollution harms the growth of vegetation and causes damage to agriculture and biodiversity as it affects both water and soil quality and consequently, fauna and flora.

In contrast, a trade-off for air quality, is an increase in the consumption of biomass to produce electricity and in industrial processes, with a possible impact resulting from an increase in emissions from non-methane volatile organic compounds (NMVOCs) and fine particulates (PM2.5), a situation which requires monitoring.

With respect to work under RCN2050, estimates were also drawn up of other air pollutant emissions. Of note is that the current National Strategy for the Air (ENAR 2014-2020) is aligned with PNAC and was developed in parallel and based on the same energy demand scenarios and with a number of common measures with regard to sector initiatives for atmospheric emissions.

It was seen that the trajectory for carbon neutrality associated with the GHG projections presented earlier, also represents potential for reducing emissions of other air pollutants by 2030 (over figures for 2005) of around:

- 68% for NOx;
- 27% for NMVOCs;
- 85% for SOx;
- 17% for NH_3;
- 37% for PM2.5.

Despite the significant reductions planned for 2030 under RCN2050, mainly in the emissions of air pollutants such as SOx and NOx, it can be seen that such reductions will be insufficient to comply with PM2.5 and NMVOC emissions ceilings as of 2030. Additional measures must be developed in the coming decade.

[54] 'Air quality in Europe' — Report by the European Environment Agency, October 2019, available at: https://www.eea.europa.eu/publications/air-quality-in-europe-2019

In 2030, PM2.5 particulates will be essentially emitted by industry, although a significant contribution will also come from the buildings sector due to the use of biomass for heating (even when contemplating an additional reduction of PM2.5 emissions resulting from the implementation of the Ecodesign Directive).

NMVOC will also be essentially emitted by industry, even when an additional reduction of emissions is considered due to the implementation of control strategies, such as measures with mitigation potential in the industrial use of solvents.

It should be noted that although the planned reduction of NH3 emissions indicates compliance with emissions ceilings, the margin of uncertainty of emissions estimates for the post 2030 period does not ensure compliance where the agricultural sector is the dominant source of NH3, contributing to the formation and secondary particulates.

As such. industry, transport, agriculture and the residential and services sectors will be the most relevant for action in the reduction of emissions of other air pollutants.

It will therefore be necessary to develop additional measures for industry, also taking into account possible additional measures for agriculture, in light of the small margin seen in relation to the 2030 ceiling (in the case of NH3).

These additional measures will be prepared under the National Air Pollution Control Programme (PNCPA), to be submitted to the European Commission, by September 2020. It will also be vital to ensure coordination of climate and air policies, also under this NECP, maximising synergies and aligning measures which both address this matter.

5.3. Overview of investment needs

i. Existing investment flows and forward investment assumptions with regard to the planned policies and measures

Decarbonisation and energy transition represent a unique opportunity for the country to consolidate an inclusive and sustainable development model focused on people and based on innovation, knowledge and competitiveness, while also contributing to improve the health and well-being of people and ecosystems.

This vision naturally forms part of this integrated energy and climate plan and must be also reflected in the different sector plans and policy instruments in the specific areas of transport, industry, commerce, services, waste, agriculture and forestry.

Although a greater need for investment is seen for the coming decade in the reduction of GHG emissions and energy transition, this investment will have broad impact and returns in all sectors of activity and the co-benefits will be seen across society.

The Portuguese transition strategy for a carbon neutral economy is based, in the medium-term, on a combination of the different policy options and measures identified above, as well as on modelled cost-effective technological options, seeking synergies between the different alternatives.

Projections showed that it is possible to achieve the planned decarbonisation and energy transition with current technologies. The development of new technologies in the future will allow targets to be reached more quickly and effectively than estimated today.

Decarbonisation and energy transition will thus stimulate a deeper and quicker transformation of society, more focused on technologies which emit less with consequences in multiple aspects of the economy, the day-to-day life of citizens and social organisation. In the final analysis, investment in carbon neutrality and energy transition

is only a small fraction of the overall investment which the Portuguese economy will have to make over time in order to remain competitive.

According to the results of RCN2050, the total amount of investment in the energy sector up to 2030 will be between 407 to 431 billion euros, of which 396 to 417 billion euros will be undertaken anyway as a result of the normal dynamics of the modernisation of the economy, driven by the policies underway to ensure the functioning of the energy system, representing an annual value of around 29 billion euros.

Total investment up to 2030 thus includes additional investment to reach carbon neutrality by 2050 of around 11 to 15 billion euros for the coming decade, in other words, around 1 billion euros per year. In addition to the reduction in emissions which, in the energy system, rises from 70% to 90%, this investment will also lead to substantial gains in energy efficiency and in a reduction in energy dependency, which will have considerable implications (positive) in the reduction of the country's energy bill.

However, it can be seen that the breakdown of total investment into normal investment and additional investment for neutrality, will change over the different decades, with the difference for neutrality gaining greater expression up to 2050 (representing around 3% of all investment in the 2016-2030 period and 13% in 2031-2040).

This investment will also be, depending on the type of investment, shared with investment by families (e.g. More efficient home appliances, electric cars, insulation in housing, etc.), by companies (for example, in renewable energies, hydrogen driven trucks, electric furnaces and boilers, etc.) and by the State (e.g. electric public transport, decarbonisation of public buildings and public vehicles, etc.). The private sector and households will be responsible for the vast majority of this investment.

The State will play a vital role in defining and adapting the regulatory and taxation systems and offer incentives which provide clear long-term signs so as to facilitate and direct the investment required for transition and avoid obsolete equipment and the maintaining of subsidies which are considered harmful for the environment.

Table 42- Estimated overall and additional volume of investment for energy sector neutrality in the 2016-2040 period

	2016-2030	**2031-2040**
Overall Total	**406.6 | 431.3**	**263.4 | 273**
Overall investment without neutrality	**395.9 | 416.6**	**229.7 | 235.1**
Electricity	22.4 | 22.1	16.6 | 19.6
Transport	193.7 | 201.3	74.5 | 62.3
Buildings	165 | 176.4	124 | 138.3
Industry	14 | 16	14.4 | 14.7
Other	0.7 | 0.8	0.2 | 0.1
Additional to achieve neutrality	**10.8 | 14.7**	**33.7 | 37.9**
Electricity	1.2 | 2.2	9 | 11.3
Transport	5.1 | 6.2	17.3 | 17.6
Buildings	3.1 | 4.8	5.6 | 6.1
Industry	1 | 1.3	1.2 | 0.9
Overall Total	**406.6 | 431.3**	**263.4 | 273**

In the electrical power production sector, the gradual reduction in the use of fossil fuels and the increase in demand caused by the growing electrification of the economy have led to the need to make significant investment in renewable capacity (also taking into account that existing capacity will also be reaching the end of working life and require replacement). It is thus expected that more than half the investment required in this sector will be in the installation of solar capacity. The first stage will be more focused on centralised solar power plants and the second stage will involve decentralised production (e.g. the rooftops of residential and services buildings) of photovoltaic power and energy communities.

Also of note are significant investments in wind farms, which will firstly focus on onshore installations, also via repowering and new equipment, and then on offshore systems.

The mobility and transport sector will be an area which will see greater technological replacement and as a consequence will require most investment, particularly to replace both goods as well as passenger vehicles. This high level of investment will be required to comply with requirements both to reduce emissions, focusing on new energy sources such as electricity and hydrogen, as well as in relation to the short working life of the equipment itself.

In the residential and services buildings sector, most investment relates to the renewal and replacement of electrical and electronic equipment for more efficient models. Although this is low-cost equipment it has significant impact in terms of quantities on a national level. Also important will be investment in building insulation, which will allow an increase in thermal comfort through a reduction in heating needs in the winter and cooling in the summer, thus reducing energy poverty.

Investment in industry will relate to energy transition, with the focus being on energy efficiency, renewable gases and electrification.

In addition to the investment identified as necessary in the energy system, other investment to consider is that required in agriculture and forestry and waste and wastewater. However, such investment is more difficult to calculate given the wide variety of factors to take into account, such as the sums required to combat rural fires, mitigation measures such as improvement in animal foodstuff digestibility, or even the implementation of circular economy measures and the reduction of organic loads.

The development of new technologies and the improvement of existing low-carbon technologies also requires significant effort investment in innovation and research which will be achieved by adopting an ambitious and wide-ranging agenda which takes into consideration all phases of the technological development cycle until sale.

ii. Sector or market risk factors or barriers in the national or regional context

N/A

iii. Analysis of additional public finance support or resources to fill identified gaps identified under point ii

Among its action lines for a carbon neutral society, the Roadmap to Carbon Neutrality 2050 identifies the need to ‘redirect financial flows to the promotion of carbon neutrality, fostering the development of a favourable framework for sustainable financing and greater involvement of the financial system, as well as the respective monitoring’.

Transiting to a carbon neutral society with a circular economy means promoting investment in the different sectors of activity, ensuring social justice in how such investment is financed. Investment in these areas will drive the economy and promote the creation of new jobs.

Although all sectors will contribute to the decarbonisation of the economy, in the coming decade it will be transport and the production and consumption of energy from renewable sources which will see the greatest change. Naturally, these areas will also see the greatest investment. Also of note will be buildings due to urban rehabilitation and the incorporation of energy efficiency measures.

Internationally, the investment necessary to comply with the Paris Agreement will come from different sources. The European Commission recognises that the vast majority of investment will be made by the private sector and families. ECOFIN also recognised the importance of ensuring that financial flows are consistent with low-carbon development, emphasising the importance of the private financial sector, as sufficient public funds do not exist for investment requirements.

It is for this reason that an international drive is being seen to reorient financial flows to energy transition and to a carbon neutral economy. Different types of financing will appear in the future, some of which can already be identified.

Particularly of note is the Action Plan to Finance Sustainable Growth, proposed by the European Commission and which seeks to reorient capital flows to sustainable investment, manage the financial risks arising from climate change and promote transparency and long-term vision in financial and economic activities. European countries are gradually focusing on the issuing of Green Bonds, as they represent a clear sign of the country's commitment to environmental sustainability.

On a European level, the Multi-annual Financial Framework 2021-2027, which is still under discussion, will be one of the main sources of financing for the decarbonisation of the economy. This is because it establishes a commitment (still under negotiation) to allocate 25% of total budget spending to climate action. As such, the preparation of the financing framework for the 2021-2027 period will reflect the guidelines set out on a European level and form one of the main sources of financing for this plan.

As a precursor, of note nationally is the National Investment Plan (NIP) 2030 which defines the decarbonisation of the economy as one of the structural areas, and contemplates more than 60% of the investment in areas which contribute to these aims.

Fiscal policy will also play an important role in the upcoming transition. Fiscal and pricing policy must be designed so that it reflects real costs, addresses the main social and environmental costs, internalising the externalities, and influencing behavioural change as a determining factor in fair and sustainable competition.

It will also play a vital role in the allocating of public funding. Fiscal policy must be aligned with the aims of energy transition and the decarbonisation of the economy, introducing the right signs into the economy while also allowing public income to be generated which can then be applied to decarbonisation measures and ensuring fair transition. As such, a green taxation policy must be pursued which has a triple dividend as its aim.

The principle must be that income generated by climate policies be channelled to ensuring the financing of the transition to a carbon neutral economy. It should be noted that the decarbonisation of the economy will lead to significant income being generated by climate policy, with emphasis on income from EU ETS licences which is allocated to the Environmental Fund.

This will allow income to be recycled, for example, to the financing of the Support Programme for the Reduction of Public Transport Tariffs (PART) and the reduction of the tariff deficit through transfers to the National Electricity System.

In this regard, the Environmental Fund will play a key role as the main instrument of the Portuguese State to finance climate action, for adaptation and mitigation, including energy transition.

The financial sector must also incorporate incentives in its investment policies and financial products which are suitable for the objectives of this plan, so that the private sector is able to access the necessary financing to make investments and acquisitions for and in an increasingly decarbonised society.

Portugal is committed to redirecting financial flows to promote decarbonisation and energy transition, fostering the development if a favourable framework for sustainable financing and greater involvement of the financial system in these areas in the coming decade. To achieve this aim, a significant contribution will come from the Sustainable Financing Analysis Group, formed in 2019, coordinated by the Ministry of the Environment and Climate Action in partnership with the Ministry of Finance and the Ministry of the Economy and Digital Transition. This group also includes the main public and private actors from the financial sector in and is supported by the Bank of Portugal.

This group identified the key areas and a series of recommendations[55] set out in the 'Guidelines to accelerate sustainable financing in Portugal'. These recommendations have different timelines so that the national financial sector can assist in the process to accelerate this transition. The active participation and consensus reached among the 20 different institutions in the Analysis Group led to the signing of the 'Letter of Commitment to Sustainable Financing in Portugal' which sets out the implementation of specific commitments for financing which promotes the decarbonisation of the economy and sustainable development.

In addition to continuing to accompany and participate in future work arising from the Analysis Group, the signatory financial institutions and Euronext Lisbon also made the following commitments:

- To promote debate among their Boards of Directors on sustainability and on the associated environmental, social and governance risks and opportunities with a view to defining their respective strategies in relation to such risks and opportunities;
- To promote training in sustainable financing for their staff at different levels (including the Board of Directors), focusing on the analysis of credit risk, financial products and the marketing and production of such products;
- To monitor the review of SME Leader and SME Excellence programme criteria so as to gradually incorporate sustainability into such criteria and accept the possibility of creating PME Green or PME Sustainable categories;
- To promote the gradual integration of environmental, social and governance criteria into financing and investment analyses.

Other equally important commitments were also made which will greatly contribute to the success of Sustainable Financing in Portugal. These commitments were made by the Bank of Portugal, the Securities Markets Commission, the Insurance and Pensions Fund Supervisory Authority, the Portuguese Association of Banks, the Portuguese Insurers Association, the Association of Publicly Quoted Companies in Portugal, the Portuguese Investment, Pension and Property Funds Association and by the Ministry of the Environment and Climate Action, the Ministry of the Economy and Digital Transition and the Ministry of Finance. Finally, so that potential investment and, consequently growth is achieved, it is vital that public policy gives clear and long-term signs to investors.

[55] Guidelines to accelerate sustainable financing in Portugal, July 2019, available at https://www.fundoambiental.pt/ficheiros/b1-linhas_orientacao_financiamento_sustentavel_ptvf-pdf.aspx

The Roadmap to Carbon Neutrality 2050 and this Plan set out a vision, the objectives and targets and the main lines of action which will determine the evolution of the national economy in the medium and long-term.

For the objectives in this plan to be achieved and for the economy to be set on a path to carbon neutrality, the following guidelines have been established:

- Maximise the new Multiannual Financial Framework 2021-2027 to guide the next financing cycle towards the decarbonisation of society and energy transition, avoiding the financing of investments which are not in line with this objective;
- Align national public funds with the aims set out in this plan, integrating criteria relating to these aims in the different lines of funding;
- Guide Direct Foreign Investment to the economy of the future, aligned with the aims of decarbonisation and energy transition;
- Make taxation an instrument for transition to a carbon neutral society;
- Align the financial system with the aims of decarbonisation, in line with work underway on a national and European level to integrate sustainable financing into the activity of financial institutions.

The Programme of the XXII Constitutional Government identifies as a challenge the mobilisation of economic incentives for decarbonisation through the implementation of green taxation and the promoting of sustainable financing. Of note among the measures identified are the drawing up of a national strategy for sustainable financing and the development of a Green Bank through the Financial Institution for Development (*Instituição Financeira de Desenvolvimento, S.A*) with the aims of providing financial capacity and accelerating existing sources of financing specialising in investment projects for carbon neutrality and the circular economy, and the promotion of (*Green Bonds*).

EUROPEAN FUNDING

The negotiations underway for the Multiannual Financial Framework 2021-2027 reinforce the need for a long-term budget for the EU 27 to be established, which will allow the priority goals undertaken to be achieved and for technological, demographic and climate change challenges to be met.

To increase the level of ambition with respect to financing the fight against climate change, the Commission proposed that at least 25% of the EU budget would be used to achieve climate action objectives. This would mean allocating 320 billion euros in the 2021 to 2027 period.

In this regard, of note are several instruments, some of which are still under negotiation, which focus on the centrality of climate policy and energy transition.

LIFE Programme - Programme for the Environment and Climate Action

This programme focuses on the development and execution of innovative forms of meeting environmental and climate challenges, such as the transition to clean energy. The Commission proposed that 5.4 billion euros be allocated in the next European budget.

The Commission increased the financing for the LIFE Programme, which saw the largest proportional increase among EU funding programmes for the 2021-2027 period. In addition to its direct action, the LIFE Programme will also function as a catalyst for other funds.

Financing will be intended mainly for environmental protection and attenuating climate change. It will support the transition to clean energies with a view to increasing energy efficiency and the share of renewable energies

in the range of energy sources. This is one of the instruments which will allow the EU to achieve its climate goals and aims to climate neutrality by 2050.

The main characteristics of the new LIFE (2021-2027) programme are as follows:

- **Continuous support for the transition to a circular economy and for attenuating climate change**: the programme mainly involves the financing required to achieve the main policy objectives as set out in the EU long-term strategic vision for a prosperous, modern, competitive and climate neutral economy by 2050. The planned measures will continue to support the full transition to a circular economy, the protection and improvement of air and water quality in the EU, the application of the EU action framework with respect to the climate and energy for 2030 and compliance with the commitments made by the Union under the Paris Agreement on Climate Change;
- **Greater attention for support in the transition to clean energy**: a new specific sub-programme will stimulate investment and support activities relating to energy efficiency and renewable energies, particularly in European regions and sectors which have fallen behind in terms of the transition to clean energy;
- **Greater attention for the protection of nature and biodiversity**: traditional elements of the LIFE Programme, the new strategic projects to protect nature are specialised and are intended for all Member States. They will contribute to the strategic objectives with respect to the protection of nature and biodiversity in other areas of action and funding programmes, such as agriculture and rural development, ensuring a more coherent approach in all sectors;
- **A simple and flexible strategy**, focused on the development and implementation of innovative forms of meeting environmental and climate challenges.

Cohesion Policy

With a total indicative budget of 273 billion euros, this policy supports sustainable development through investment in adaptation to climate change and risk prevention, as well as environmental and infrastructure protection measures. The sustainable development objectives are set out in the regulations which govern the funds and which must be promoted at all stages of preparation and implementation. Of note in this regard are the Regional Development Fund and the Cohesion Policy requiring Member States to invest 30% to 50% of their part of the Regional Development Fund (ERDF) in innovation related projects, and at least 30% in projects which combat climate change and contribute to the circular economy. 6% to 10% of national ERDF is also required to be allocated to sustainable urban development. The Cohesion Fund will continue to focus on investment in environmental and transport infrastructure.

InvestEU

This is a new European Union instrument providing guarantees with the aim of mobilising public and private financing for strategic investment under table policy framework. It includes compliance with requirements for investment sustainability and aid in orienting capital flows towards sustainable investment.

The InvestEU programme will cover the period from 2021 to 2027 and will bring a wide variety of EU financial instruments which are currently available under a single umbrella, thus expanding the model of the Juncker Plan. The InvestEU Fund will mobilise public and private investment through a guarantee from the EU budget of 38 billion euros which will support the investment projects of financial partners such as the group of the European Investment Bank (EIB) and others, reinforcing their risk absorption capacity. Financial partners must contribute a minimum of 9.5 billion euros of risk absorption capacity. It is hoped that, in conjunction with the banking sector, that it will be possible to leverage at least 650 billion euros of investment. The guarantee is required to have a provision equivalent to 40%, meaning that a reserve of 15.2 billion euros from the EU budget

is created in the event of it being necessary to activate the guarantee.

This budget guarantee will be divided among the different areas of intervention as follows:

- Sustainable infrastructure, with 11.5 billion euros;
- Research, innovation and digitalisation, with 11.25 billion euros;
- Small and medium enterprises, with 11.25 billion euros;
- Social and skills investment, with 4 billion euros.

The EIB will continue to be the Commission's main partner under the InvestEU Programme. Furthermore, under certain conditions, regional and national development banks and other Member State institutions able to provide specific knowledge and experience may become financial partners.

The decision to broaden the possibility of benefiting from the EU guarantee to other institutions is due to the fact that other experienced potential financial partners exist in the EU which have specific sector or financial competences, excellent knowledge of the local market or greater capacity for sharing risks with the EU in certain sectors. This approach will increase and diversify the project reserve and increase the potential number of final beneficiaries.

Connecting Europe Facility Mechanism (CEF)

European Commission COM(2018) 438 final of 6 June 2018 proposes a review of the 'Connecting Europe Facility' (CEF, currently defined in Regulations (EU) 1316/2013 and (EU) 283/2014) for the 2021-2027 period, which will allow the funding of infrastructure projects in the energy, transport and digital sectors.

In the energy sector, this funding facility is directly related to European Union Projects of Common Interest (PCIs), under Regulation (EU)347/2013 on trans-European energy infrastructure (Regulation TEN-E). This review of the CEF facility also sets out a new area for the energy sector relating to cross-border renewable energy projects. Of note in the transport sector is the setting up of pre-defined railway corridors and stretches. Cross-border stretches are planned for the 'Atlantic' corridor 'Évora – Mérida' and 'Aveiro – Salamanca'.

The total planned budget for the new CEF facility for the 2021-2027 horizon is around 43 billion euros broken down among the respective sectors: 31 billion euros in the transport sector; 9 billion euros in the energy sector; and 3 billion euros in the digital sector. It is expected that the new regulation defining the new CEF facility will be concluded in 2019. The current CEF facility is defined for the 2014-2020 horizon.

Common Agricultural Policy (CAP)

According to the Commission's proposal, CAP has a total budget of 365 billion euros, 40% of which is required to covering to climate action. According to the Commission's proposal, CAP seeks to lead the transition to a more sustainable agriculture. The aims are to promote the resilience of the sector and support the income and viability of farmers. It is required to ensure that agriculture fully plays its role in the environment and with respect to climate change and that it fully integrates the digital innovations which facilitate the work of farmers, reduce bureaucracy and support generational renovation. More than 50% of the EU population live in rural zones and efforts are therefore required to maintain these rural areas attractive as vital places to live in terms of growth and employment, but also in terms of infrastructure, mobility and basic services. By contributing to the economic dynamics of rural zones and to respective socio-cultural life, EU agriculture plays an important role. The same situation applies to the new CAP, which seeks to maintain substantial agriculture throughout Europe, investing in the development of rural areas and communities.

The future CAP will focus on nine general aims which reflect the economic, environmental and social importance of this policy:

- Support income and the resilience of viable farms throughout the EU in order to reinforce food security;
- Reinforce market orientation and increase competitiveness, with greater emphasis on research, technology and digitalisation;
- Improve the position of farmers in the value chain;
- Contribute to adaptation to climate change, to the mitigation of its effects, and to sustainable energy.
- Promote sustainable development and the efficient management of natural resources such as water, land and air;
- Contribute to the protection of biodiversity, improve services connected to ecosystems and preserve habitats and landscapes;
- Attract young farmers and facilitate the development of companies in rural areas;
- Promote employment, growth, social inclusion and local development in rural areas, more specifically, the bio-economy and sustainable forestry;
- Improve the response by European agriculture to the demands of society with respect to food products and health, including the supply of safe, nutritive and sustainable foodstuff products, while also improving animal welfare.

Foster knowledge, innovation and digitalisation in agriculture and rural development as a transversal objective.

Horizon Europe

With an indicative budget of 97.6 billion euros, this programme specialises in research and innovation and is a driver of economic growth and employment. Its aim is to support policies for transition to a low-carbon economy, environmental protection and climate action. Horizon Europe is proposed as the most ambitious funding programme ever for research and innovation with the goal of driving scientific excellence in Europe, enhancing the scientific, economic and society impact of EU funding. Its main lines of action are: Reinforce science and technology in the EU due to the increase in investment in highly qualified people and innovative research; Promote the industrial competitiveness of the EU and its performance in innovation, more specifically by supporting the creation of innovation through the European Innovation Council and the European Institute of Innovation and Technology; Comply with the EU's strategic priorities, such as the Paris Agreement on climate change, and tackle the challenges which affect the quality of life of Europeans.

The fund is built on three pillars, and of note in this regard is Pillar 2 - Global Challenges and Industrial Competitiveness (52.7 billion euros) which directly supports research into social challenges, reinforces technological and industrial capacities and EU level missions with the ambitious objective to tackle a number of the EU's major problems. Of note among the clusters selected are Digital and Industry, the Climate, Energy and Mobility and Food and Natural Resources.

Innovation Fund (NER 450)

The Innovation Fund is one of the largest funding programmes for demonstrating projects for innovative low-carbon technologies and focuses on:

- Innovative low-carbon technologies and processes in carbon intensive industries, including the substitution of carbon intensive products;
- Carbon capture and use (CCU);
- Construction and maintenance of carbon capture and storage;
- Production of innovative renewable electricity;

- Energy Storage.

Income for this fund comes from the auctioning of ETS licences. For this purpose, 450 million licences have been allocated for between 2020 and 2030. The money not used by the NER 300 programme will also be allocated to this fund.

It is estimated that the Innovation Fund could stand at 10 billion euros, depending on the price of carbon. In addition to the fund, EU ETS also constitutes the largest long-term incentive for the application of innovative and low-carbon technologies.

The Innovation Fund is a key element to achieving the aim of a carbon neutral Europe by 2050 and for complying with the Paris Agreement.

Innovation Fund

The Innovation Fund is one of the largest funding programmes internationally for demonstrating projects for innovative low-carbon technologies. This fund focuses on: innovative, low-carbon technologies and processes in intensive energy industries, including products which substitute carbon-intensive products; carbon capture and use (CCU); carbon capture and storage (CCS); innovative generation of renewable energy; energy storage. The budget for this fund could reach approximately 10 billion euros, depending on the price of carbon.

InnovFin Energy Demo Projects

This funding mechanism consists of loans, loan guarantees or property type funding, normally between 7.5 to 75 million euros for innovative projects to transform energy systems, including: renewable energy technologies, smart energy systems, energy storage, carbon capture and storage and carbon capture and use. This funding mechanism is complemented by the European Investment Bank.

Just Transition Fund

The Just Transition Fund is a new fund to support the transition of regions most affected by the need to abandon an economic model built on fossil fuels to a carbon-neutral scenario, and is intended for regions which are carbon intensive. The Just Transition Fund will be one of the initiatives to be presented under the European Green Deal as a result of the work of the new Commission. Although the eligibility criteria and type of project to be supported are still under discussion, it is hoped that some regions of Portugal will be able to benefit.

European Investment Bank

The European Investment Bank (EIB) is the largest multilateral financial institution in the world, and is one of the entities with greatest weighting in climate financing. The EIB is the bank in the European Union which focuses on granting loans and strives to finance projects which contribute to achieving the aims of the European Union. The EIB has recently taken on the role of Europe's climate bank, after the approval of an energy lending policy which explicitly seeks the end to the financing of fossil fuel infrastructure as of 2021. The EIB is also the largest shareholder in the European Fund for Strategic Investments (EFSI), which funds investment in small and medium enterprises.

EFSI is one of the three pillars of the Investment Plan for Europe and its aim is to overcome current market shortcomings, addressing these failings and mobilising private investment. Assist in the funding of strategic investment in key areas such as infrastructure, research and innovation, education, renewable energy and energy efficiency, and also to provide risk financing for small and medium enterprises (SME).

NATIONAL PUBLIC FINANCING

With respect to public financing, national funds currently exist which support the decarbonisation of the economy and energy transition and provide a number of funding possibilities which are available to both the public and private sectors.

The application of this plan will require the strengthening of action by the funds identified with emphasis on the objectives established, together with close coordination between the different sources of funding. The application of European funds will also be equally important.

Environmental Fund (EF)

The aim of the EF is to support environmental policies to achieve sustainable development objectives, thus contributing to compliance with national and international objectives and commitments, more specifically those relating to climate change, water resources, waste and the preservation of nature and biodiversity.

This instrument provides grants for projects which contribute to public environmental policies through applications which are submitted further to notices. Beneficiaries of this fund include: companies, NGOs, public entities, municipalities or foundations. Each notice identifies the respective beneficiaries.

The EF has played an important role in supporting projects for the decarbonisation of the economy, with special not for the fact that its main source of income comes from the auctioning of EU ETS licences.

Innovation, Technology and Circular Economy Fund (ITCEF)

This fund was created through Decree-Law No 86-C/2016 of 29 December 2016 and its purpose is to support policies which enhance scientific and technological knowledge, transforming such knowledge into innovation, while also stimulating cooperation among higher education institutions, technological interface centres (TCI) and companies. It also seeks to promote the more efficient use of resources through material and energy efficiency.

Energy Efficiency Fund (EEF)

The Energy Efficiency Fund (EEF) was created through Decree-Law No 50/2010 and its purpose is to fund the programmes and measures provided for in the National Action Plan for Energy Efficiency (PNAEE), as set out in the annex to Council of Ministers Resolution No 80/2008 of 20 May 2008. This is achieved through the following lines of action: a) Support for projects which are predominantly technological in nature in the transport, residential and services, industry and public sectors; b) Support for actions which are transversal in nature and engender energy efficiency in behaviour, taxation and incentives and financing.

Fund for the Systemic Sustainability of the Energy Sector (FSSES)

The Fund for the Systemic Sustainability of the Energy Sector, created by Decree Law No 55/2014 of 9 April 2014 seeks to promote balance and systemic sustainability between the energy sector and national energy policy by funding energy sector policies which are social and environmental in nature and are related to measures for energy efficiency and reducing the national electricity system tariff debt.

Innovation Support fund (ISF)

The aims of ISF are to support innovation, technological development and investment in renewable energies and energy efficiency in order to achieve the targets set out in PNAER, PNAEE and the National Energy Strategy. ISF can support projects through reimbursable and non-reimbursable subsidies, and any public or private entities may submit applications to ISF.

Fundo Azul

The aim of the Blue Fund, created through Decree-Law No 16/2016 of 9 March 2016, is to develop the maritime economy, scientific and technological research, the protection and monitoring of the marine environment and

maritime security. This is achieved by creating or reinforcing funding mechanisms for entities, activities or projects which meet the needs set out in the abovementioned Decree-Law.

National Fund for Building Rehabilitation (NFBR)

The Building Rehabilitation (NFBR) is a special property investment fund, which is a privately subscribed closed fund to develop rehabilitation projects aimed mainly at the permanent housing rental market, thus providing housing under favourable conditions. The main aim of NFBR is to develop and implement property rehabilitation projects for housing rental with a view to urban regeneration and bringing people back to urban centres. The goal is to achieve growth in the investment over the medium and long-term. The Social Security Fund for Financial Stabilisation (SSFFS) may contribute funds and NFBR may also use other forms of financing.

Other funding mechanisms

- The **Energy Efficiency Credit Line**, an agreement between the investment body SPGM, and the Mutual Guarantee Societies, Agrogarante, Garval, Lisgarante and Norgarante and the main national credit institutions, has 100 million euros to enable industrial and tourism companies more modern and competitive by implementing measures which reduce energy consumption and the change from fossil fuel energy to renewable energy. This approach contributes to the national targets set out in the National Action Plan for Energy Efficiency (PNAEE) and in the National Action Plan for Renewable Energies (PNAER). The beneficiaries are micro and small and medium enterprises, certified by an electronic declaration issues by IAPMEI, located in national territory, whose main activity features on the agreed list of Economic Activity Codes (CAE) as set out in Annex I of the Dissemination Document, which do not have uncorrected incidents at banks and are up to date with bank responsibilities, taxation and social security payments at the time of funding.
- The **Efficient House Programme (*Casa Eficiente 2020*)** grants loans under favourable conditions to operations which promote the improvement of the environmental performance of private housing, with special focus on energy and water efficiency and on the management of urban waste. Owners of residential buildings or parts thereof and the respective condominiums may submit applications. Buildings may be located anywhere in national territory. Operations may involve private or common areas. The programme is run by the Portuguese State and promoted by CPCI – Portuguese Construction and Property Confederation. Technical support is provided by APA - Portuguese Environmental Agency, EPAL – Portuguese Water Company and ADENE – Energy Agency. The programme is co-funded by the European Investment Bank and by participating commercial banks which act as financial intermediaries between EIB and beneficiaries. For the 2018 to 2021 period, total funding under the programme stands at 200 M€, with 100 M€ coming from the EIB credit line and a further 100 M€ from the commercial banks.
- The aims of the **Financial Instrument for Urban Rehabilitation and Revitalisation 2020** (IFRRU 2020) are to revitalise cities, support the rehabilitation of areas dedicated to disadvantaged communities and support energy efficiency in housing.
- The **Renovate to Rent** and **Renovate to Rent – accessible housing programmes** provide funding for rehabilitation operations in buildings which are 30 or more years old. After such rehabilitation, such buildings are required to be predominantly for housing purposes, and in the case of ‘accessible rent’, the dwellings are intended for rent under the conditional rental regime.

- The purpose of the **Plan to Promote Efficiency in the Consumption of Energy** (PPEC) is to promote measures to improve efficiency in the consumption of electrical energy though actions undertaken by different sector agents (from suppliers to consumers).

FINANCING THROUGH THE PRIVATE FINANCIAL SECTOR

International dynamics with respect to sustainable financing has led to the development of new financial products. It is thus expected that some of these products will also be developed in Portugal by the Portuguese financial sector. A number of European financial institutions have placed financial products on the market which stimulate access to financing which has a positive environmental impact, these include green bonds, green loans, sustainable investment funds and impact funds.

- **Green Bonds** - Green Bonds are any type of bond instrument where the value of the debt taken on will be exclusively used to finance or refinance, wholly or partly, new and/or eligible green projects. The definition of project eligibility is normally governed by the Green Bond Principles issued by the International Capital Market Association (ICMA). The European Commission (as of May 2019) is working on the definition of a European standard for green bonds. This is a market which is undergoing growth and in 2018 the total value of green bonds issued internationally reached 167.3 billion dollars. The countries responsible for the issue of 47% of such green bonds were the USA, China and France. On an international level, there are numerous banks providing corporate clients with this method of raising capital. It is therefore expected that the use of green bonds will increase significantly as investors have reacted positively to companies and countries which present such options for capturing investment. In Portugal, at least two corporate groups have already issued green bonds as a way of financing green projects and technologies.
- **Green Loans:** Green loans refer to any type of loan instrument provided exclusively to finance or re-finance, in whole or in part, new projects, and/or existing eligible green projects. They consist of allocating a loan to an entity where the rate of interest depends on the company's capacity to achieve the environmental goals defined and agreed between the financing institution and the borrower. For a loan to be considered green, several procedures are referred to in the Green Loans Principles produced by the Loan Market Association. This option is currently available in a number of international banks which provide companies with the possibility of taking out a green loan that is for the general operation of the company (and not for a technology or specific project as is the case with Green Bonds) and which may benefit from a lower interest rate, if the company, as a whole, achieves certain specifically defined objectives.
- **Sustainable investment funds:** Sustainable investment funds are those which have environmental, social and governance criteria in the selection of their assets. In other words, they are funds which seek to acquire company shares and/or bonds which have demonstrated sustainability practices. These funds are experiencing significant growth, and 53% of European funds have some type of environmental, social and governance criteria in the structuring of their portfolio. On an international level, only 26% of funds incorporate any type of sustainability criteria, demonstrating the pioneering nature of the European capitals market.

  Impact Funds: Impact Funds are investments made in companies, organisations and funds with the intention of generating measurable environmental and social impact together with a financial return. Impact Funds are associated with philanthropic investors and foundations seeking to invest in projects which bring about a positive environmental and social impact, and which also generate some type of financial return. This type of fund is also experiencing growth, and internationally, around 228 billion dollars are currently invested with an impact approach.

- **Blended Finance**: Another funding concept which has appeared is called Blended Finance. It arose with the aim of catalysing the mobilisation of additional capital for investment related to sustainable development. Blended Finance uses a combination of public and private financing (or philanthropic) to fund projects with significant impact on development and to improve a project's risk-return profile, in other words, its commercial viability for a private investor.

The investment dynamics associated with the decarbonisation of the economy and energy transition also constitute an opportunity for innovation in the financial sector through the creation of new products and services for this new green economy. Moreover, the financial sector must analyse the continuation of investments in the 'brown economy' so as to avoid stranded assets. These approaches contribute to reducing the risks associated with investment and help capture new clients.

5.4. Impacts of planned policies and measures in other Member States and on regional cooperation

i. Impacts on the energy system in neighbouring and other MS in the region (*)

With respect to energy systems, the objectives and targets defined and the respective policies are expected to result in greater systems integration and improved levels of connection, leading to higher resilience for both the national and Spanish energy systems (as a neighbouring Member State).

The impact for other MS will be conditioned by the level of EU internal market integration. For increasingly improved levels of integration, already identified obstacles and constraints will have to be overcome.

ii. Impacts on energy prices, public services and the integration of the energy market

From a regional perspective, it is considered that the objectives and targets and policies and measures planned (set out in Chapters 2 and 3, respectively) for both the Iberian Electricity Market (MIBEL) as well as the Iberian Natural Gas Market (MIBGÁS) will bring greater maturity and liquidity with positive impacts, for example on energy prices.

It should also be noted that growing technological maturity, with a consequent reduction in investment costs in facilities, as well as the implementation of measures regarding taxation, tariffs and systems costs could impact on the functioning of markets with a knock-on effect on energy sale prices.

iii. If relevant, impacts on regional cogeneration

Not available at this stage.

Annex I

Cost of the main technologies considered in the JANUS model and in the TIMES_PT model

Table - Cost of the technologies considered in the Janus model

Version 18-12-2018	Investment (€/W)						MO fixed (€/W)						MO variable (€/MWh)			
	2016		2030		2040		2016		2030		2040		2016	2030	2040	
Coal	1.9	4	2.3	4	2.3	4	0.035	4	0.035	4	0.035	4	3.4	3.4	3.4	4
Fuel Oil	1.2	4	1.2	4	1.2		0.021	4	0.021	4	0.021		2.76	2.76	2.76	4
Diesel	1.2		1.2		1.2		0.021		0.021		0.021		2.76	2.76	2.76	
Natural Gas	0.8	4	0.765	4	0.765	4	0.022	4	0.021	4	0.020	4	1.99	1.90	1.81	4
Biogas	0.94	4	0.92	4	0.92	4	0.023	4	0.02	4	0.019	4	0.71	0.71	0.71	4
Incineration of biomass	4.7	4	4,7*0,9	4	4.7*0.9*0.9	4	0.047	4	0.04	4	0.039	4	3.56	3.56	3.56	4
Waste incineration	2.03	4	2.01	4	2.00	4	0.052	4	0.044	4	0.042	4	0.81	0.81	0.81	4
Solar	0.7	12	0.645	12	0.477	12	0.013	12	0.0122	12	0.0115	12	0	0	0	
Solar PV concentrated (CPV)	2.2	8	1.1	8	1,1*0,9		0.022	6	0.011	6	0,011*0,9		0	0	0	
Solar PV with storage	0,8*1,2		0,34*1,2		0.34*0.9*1.2		0,008*1,2		0,003*1,2		0.03*0.9*1.2		0	0	0	
Solar thermal concentrated (CSP)	5.1	7	5,1*0,9		4,59*0,9		5,1*0,02		5.1*0.9*0.02		5.1*0.9*0.9*0.02		0	0	0	
Ocean waves	5	5	2.4	5	2,4*0,9		0.15	5	0.072	5	0,072*0,9		0	0	0	
Floating off-shore wind	4.6	5	2.4	5	2,4*0,9		0.138	5	0.072	5	0,072*0,9		0	0	0	
On-shore wind	1.0	12	0.98	12	0,88*0,9		0.018	12	0.018	12	0,018*0,9		0	0	0	
On-shore wind with storage	1*1,2		0,88*1,2		0.88*0.9*1.2		0,03*1,2		0,017*1,2		0.017*0.9* 1.2		0	0	0	
Stimulated binary geothermal	4.97	4	4.47	4	4.37		0.095	4	0.095	4	0.095		0.32	0.32	0.32	4
Hydro - small	1.6	7	1.6	7	1.6	7	0.05	7	0.05	7	0.05	7	0.002	0.002	0.002	7
Hydro - large	1.3	7	1.3	7	1.3	7	0.03	7	0.03	7	0.03	7	0.0025	0.0025	0.0025	7
Hydro with pumping	2.8	2	2.8	2	2.8	2	0.06		0.06		0.06					
Batteries (Li)	2.1	10	1	10	0.9		0.0045	11	0.0045		0.0045					
PEM Electrolyzer	1.2	4 10	0.7	4 10	0.7	4	1,2*0,02	4	0,7*0,02		0,7*0,02					
Pem Fuel cells	3.5	13	2	13	2*0,8	13										
Synthetic fuels (H2)	0.5	14	0.3	14	0.3* 0.8	14										
Biofuels - pyrolysis	1.2	9	1,2*0,8	9	1.5*0.8*0.8	9	1,5*0,03	7	1.5*0.8* 0.03	7	1.5*0.8*0.8**0.03	7	4	4	4	7
Biofuels - gasification	2	15	2*0,8	15	2*0.8* 0.8	15	2*0,03	7	2*0.8* 0.03	7	2*0.8*0.8** 0.03	7	4	4	4	7
Advanced biofuels	3	9	2.5	9	1.5	9	3,5*0,03	9	2,5*0,03	9	1,5*0,03	9				
Biogas	1.3	12	1.25	12	1.15	12	0.0288	12	0.0243	12	0.0238	12	2.56	2.56	2.56	12
H2 Injection	0.542	12	0.412	12	0.379	12	1.7	12	1.7	12	1.7	12				

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Table - Cost of the main technologies for generating electricity considered in the model TIMES_PT (prices €2 000)

Gas	Investment Costs (2015)	Investment Costs (2030)	Investment Costs (2040)	Fixed costs (2015)	Fixed costs (2030)	Fixed costs (2040)	Variable costs (2015)	Variable costs (2030)	Variable costs (2040)	References
	€/KW	€/KW	€/KW	€/KW	€/KW	€/KW	€/GJ	€/GJ	€/GJ	
Conventional combined gas cycle	759	759	759	18.96	18.96	18.96	0.48	0.48	0.48	JRC (2013)
Advanced combined gas cycle	488	488	488	9.01	9.01	9.01	0.52	0.52	0.52	EDP (2017)
Gas cycle combined with CO2 capture post combustion		888	864		31.74	31.05		0.20	0.20	JRC (2013)
Open Gas Cycle (Peaker) Advanced (OGCC)	373	366	364	9.39	9.20	9.16	0.46	0.46	0.46	JRC (2013)
Diesel	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/GJ**	**€/GJ**	**€/GJ**	
Fuel oil steam turbine (Supercritical)	1 399	1 113	1 012	17.94	17.86	17.83	0.58	0.58	0.58	JRC (2013)
Diesel Turbine (Peaker) Advanced	385	377	375	12.20	11.95	11.90	0.52	0.52	0.52	EDP (2017)
Coal (Anthracite)	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/GJ**	**€/GJ**	**€/GJ**	
Subcritical (Conventional)	1 049	1 049	1 049	20.98	20.98	20.98	0.27	0.27	0.27	JRC (2013)
Supercritical	1 307	1 307	1 307	26.13	26.13	26.13	0.55	0.52	0.49	JRC (2013)
Fluidized Bed	1 927	1 927	1 927	38.54	38.54	38.54	0.26	0.26	0.26	JRC (2013)
Integrated gasification combined cycle (IGCC)	2 014	1 727	1 558	40.28	34.53	31.17	1.23	1.23	1.23	JRC (2013)
IGCC with Pre Combustion CO2 Capture		1 880	1 712		30.58	27.60		0.25	0.25	JRC (2013)
Supercritical + Post Combustion CO2 Capture		1 732	1 698		31.16	28.12		0.63	0.61	JRC (2013)
Supercritical + Oxy Fuel CO2 Capture		1 758	1 486		28.70	25.90		0.96	0.91	JRC (2013)
Nuclear	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/GJ**	**€/GJ**	**€/GJ**	
Nuclear 3rd generation (Light Water reactor)	3 843	3 843	3 843	69.71	69.71	69.71	0.70	0.67	0.65	JRC (2013)
Nuclear 4th generation (Fast reactor)			5 019			57.41	0.70	0.67	0.65	JRC (2013)
Hydro	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/GJ**	**€/GJ**	**€/GJ**	
Run-of-river type hydropower	1 068	970	888	10.68	9.70	8.88				TIMES_PT Database; JRC/EDP
Hydro-electric Dam (High AF)	771	747	721	7.71	7.47	7.21	0.47	0.47	0.47	TIMES_PT Database; JRC/EDP
Hydro-electric Dam (Low AF)	771	747	721	7.71	7.47	7.21	0.47	0.47	0.47	TIMES_PT Database; JRC/EDP
Hydro-electric Dam with pumping	593	574	554	5.93	5.74	5.54	0.47	0.47	0.47	TIMES_PT Database; JRC/EDP
Geothermal	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/GJ**	**€/GJ**	**€/GJ**	
Enhanced Geothermal System (Hot dry rock)	6 096	4 612	4 612	213.36	161.40	161.40				JRC (2013)
Geothermal hydrothermal with flash	1 676	1 537	1 537	58.67	53.80	53.80				JRC (2013)
Wind	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/KW**	**€/GJ**	**€/GJ**	**€/GJ**	
Floating off-shore wind	3 596	2 194	1 938	115.07	70.22	62.02				IRENA (2018)
On-shore wind	826	736	721	30.04	30.04	30.04				EDP (2017)
Micro Wind	4 291	3 173	2 832	85.82	63.46	56.64	0.10	0.09	0.07	WWEA (2016); Distributed Wind market Report US (2016)