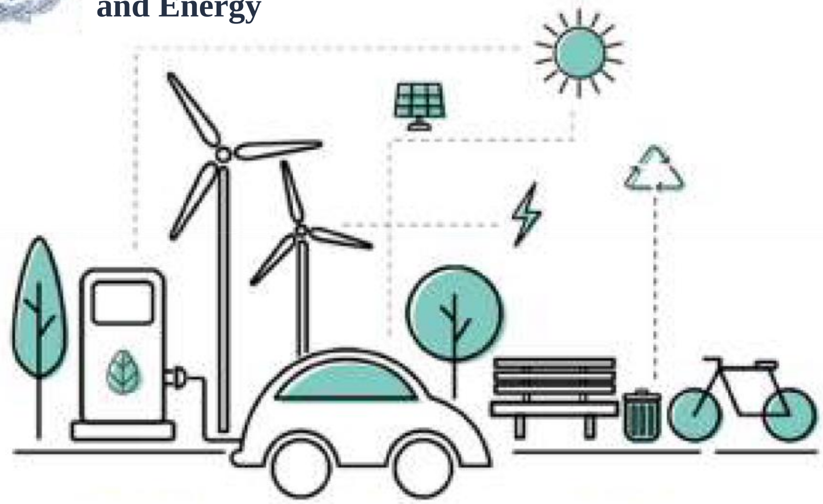
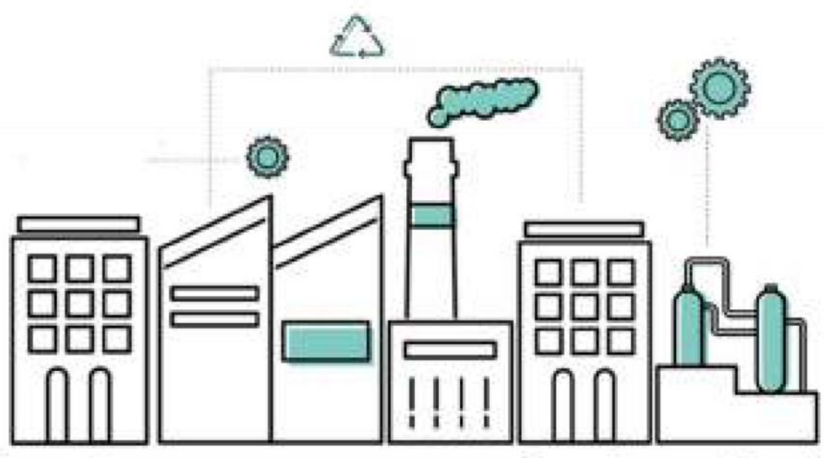
HELLENIC REPUBLIC
Ministry of the Environment
and Energy



National
Energy *and Climate*
Plan



ATHENS, DECEMBER 2019

INTRODUCTION

The National Energy and Climate Plan (NECP) is the Greek government's strategic plan for climate and energy issues, setting out a detailed roadmap regarding the attainment of specific energy and climate objectives by 2030. The NECP sets out and describes priorities and policy measures in respect of a wide range of development and economic activities intended to benefit Greek society, and therefore it is a reference text for the forthcoming decade.

The objectives set in the context of the NECP are quantified and cost-accounted, and intermediate milestones have been defined, allowing for following up on the progress made in attaining the objectives and relating to the successful adoption and functioning of a mix of policies and measures. More specifically, these priorities and measures will be used as a basis for identifying and highlighting the need for synergies and complementary actions in all sectors/branches of the Greek economy.

The NECP stresses Greece's priorities and development potential in terms of energy and addressing climate change and aims to serve as the *key tool for drawing up the national energy and climate policy in the next decade*, taking into account the Commission's recommendations and the UN sustainable development goals.

The government's strategic aim is that the energy and climate objectives set in the context of the NECP by 2030 should contribute substantially to the necessary energy transition in the most economically competitive manner for the national economy, should ensure a sharp reduction in greenhouse gas emissions and should ultimately make Greece stand out as one of the Member States that have adopted ambitious climate and energy objectives, through a comprehensive and cohesive programme of measures and policies, thus placing Greece at the core of developments in the Energy Union both for 2030 and, ultimately, for 2050.

This transition will be coupled with strengthening the competitiveness of Greek undertakings and protecting consumers, by establishing a framework for the sustainable development of the national economy, making optimal use of national and European financing mechanisms and adopting appropriate market mechanisms also in line with EU law.

More specifically, the NECP as a whole lays down national energy and climate objectives for 2030 which are much more ambitious than both those of the initial NECP draft presented in January 2019 and the core EU objectives set in the context of the Energy Union. The NECP also aims to contribute to the new green deal promoted by the Commission, which is expected to incorporate both new mechanisms and financing priorities for supporting energy and climate transition, also strengthening the competitiveness of the European economy.

More specifically, the NECP has set the following objectives for 2030:

(a) Initially with regard to climate change and emissions, a much higher core objective for reducing greenhouse gas (GHG) emissions by more than 42% compared to emissions in 1990 and more than 56% compared to emissions in 2005, thus exceeding even the core EU targets. It should be stressed that these objectives were much lower in the initial NECP draft, resulting in a reduction of 33% and 49% respectively. These new objectives for reducing GHG emissions are also a prerequisite for making possible the transition to a climate neutral economy by 2050, as the Greek government aims to participate on a pro rata basis in the commitment for a climate neutral economy at an EU level.

Also, in respect of climate change and adaptation policies, the NECP sets out the initiatives to be undertaken in the context of the National Strategy for Adaptation to Climate Change, which defines the general objectives, guidelines and tools for the implementation of necessary climate adaptation measures at national, regional and local levels. It also sets out initiatives for the completion of physical planning, in urban areas in particular with respect to sustainable land use and the promotion of sustainable urban mobility. Waste management is an integral part of the national energy and climate plan, and therefore the relevant initiatives for revising the national and regional waste management plans (NWMP and RWMP) are presented. The objective of these plans is to intensify a number of integrated waste management measures, always in line with the requirements of the circular economy.

Moreover, the circular economy is a core element of Greece’s development strategy, and its implementation includes, inter alia, a four-year strategic plan that covers the entire range of the value chain. In this context, the NECP sets out the axes of the relevant policy.

(b) With regard to renewable energy sources (RES), a much higher objective concerning the share in gross final energy consumption, as there is now an objective for a minimum share of 35%, compared to 31% in the initial NECP draft. This is also much higher than the core EU objective for RES of 32%.

We should also stress the energy transformation to take place in power generation, as provision has been made for the RES share in electricity consumption to exceed 60%. In this context specific initiatives are already being promoted and implemented by the government, e.g. simplifying and speeding up the licensing framework, ensuring optimal integration of RES in electricity networks, operating storage systems and promoting electrmobility.

(c) With regard to improving energy efficiency, also a much more ambitious objective than that of the initial NECP draft and the corresponding EU objective. More specifically, there is a quantitative objective for final energy consumption in 2030 to be lower than that recorded in 2017. Therefore, the NECP's objective is fully compatible with the relevant EU indicator. There is also a 38% qualitative energy efficiency improvement achieved in final energy consumption, in accordance with a specific EU methodology, compared to the corresponding core EU objective of 32.5% and the initial NECP draft target of 32%. Attaining this ambitious objective will strengthen the competitiveness of the Greek economy and the protection of consumers. The NECP sets out a set of energy efficiency improvement measures, the most ambitious ones relating to buildings and transport.

A key objective in the context of the new revised government strategy for the NECP is the highly ambitious, but realistic programme for sharply and definitively reducing the share of lignite in power generation, i.e. the so-called **lignite phase-out**, by implementing a relevant front-loaded programme in the following decade and **putting a complete end to the use of lignite for power generation in Greece by 2028**. The NECP also sets out the timeframe for shutting down the lignite-fired power plants that are currently in operation, which will be completed by 2023.

This objective also incorporates the government's vision to address environmental protection issues in the long term and rationalise power generation costs in Greece now.

The lignite phase-out plan for power generation in Greece also involves adopting integrated programmes for supporting lignite-producing areas in Greece, to smooth out the transition to the post-lignite era. The Greek government is committed to shutting down lignite-fired plants by 2028 in a well-coordinated and responsible manner. Maintaining jobs and utilising the expertise of human resources in these areas are a top priority.

An integrated, multi-faceted and front-loaded plan (Just Development Transition Master Plan) will be presented in mid 2020, to serve as a roadmap for the post-lignite era.

The Greek government have the political will and the required know-how to utilise the resources that are readily available at a national level and claim increased funds from EU financing funds, from the Just Transition Fund in particular.

Lignite phase-out is a sea change in the national energy map, but also a huge opportunity for Greece. The spirit of innovation that was ushered by the use of lignite will be passed on to the clean forms of energy and the new energy mix of the 21st century.

The NECP includes and sets out corresponding measures for other strategic policy priorities such as:

- speeding up the electrical interconnection of the islands;
- launching the new electricity market model without further delay;
- strengthening energy interconnections;
- developing strategic storage projects;
- digitising the energy networks;
- promoting electromobility;
- promoting new technologies;
- coupling the final sectors;
- developing new financial instruments; and
- taking initiatives for research and innovation and for enhancing competitiveness;

thus demonstrating the government's holistic approach to planning climate and energy policies and measures.

To attain the above objectives, the NECP sets out and details the individual policy priorities for the following period and the corresponding policy measures that are being planned for implementing the priorities and attaining the objectives of the NECP, under seven different themes (1. Climate change, emissions and removals of greenhouse gases, 2. Renewable energy sources, 3. Improvement in energy efficiency, 4. Security of energy supply, 5. Energy market, 6. Agriculture, shipping, tourism (new theme), and 7. Research, innovation and competitiveness).

A key component of this plan is the governance of the project as a whole, which is stressed in the text of the NECP that describes specific actions, as all measures in the individual sectors are part of an integrated plan for the optimal attainment of the national energy, environmental, socio-economic and development objectives, which requires cohesion, horizontal combination and coordinated monitoring of the priorities and of the implementation of the relevant measures.

The development of the energy system by 2030 is detailed in the relevant chapters of the NECP, using two energy models that are internationally and scientifically recognised, thus further strengthening the technical reliability and completeness of the project. Moreover, the impact of the implementation of the proposed policies and measures are assessed, demonstrating its positive effect on the competitiveness of the Greek economy and the improvement of living conditions.

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Chapter 1 PLAN OVERVIEW AND DRAFTING PROCEDURE

1.1 Executive summary

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

The National Energy and Climate Plan (NECP) is a balanced mix of ambitious and rational national energy policy, aiming primarily to ensure the attainment of the EU's Energy Union goals by 2030. Such an energy transition requires a higher objective for reducing GHG emissions, increased penetration of RES in gross final energy consumption, improved energy efficiency for higher energy savings, and lignite phase-out in power generation, to make sure that this radical energy sector transformation does lead to a climate neutral economy by 2050, for the benefit of the society and the environment.

On the basis of the new strategic agenda 2019-2024 adopted by the Council on 20 June 2019, the success of this green transition towards building a fair and social Europe will depend on the substantial mobilisation of private and public investment, the consolidation of an effective circular economy and an integrated, interconnected and properly functioning EU energy market. This market will provide sustainable, secure and affordable energy, with full respect for the Member States' right to decide on their own energy mix. This will enable the EU to reduce its dependence on external sources, diversify its supply and invest in solutions for the mobility of the future. Therefore, the systemic nature of climate and environmental challenges makes it necessary to develop sustainable policies incorporating all three dimensions of sustainable development (social, environmental, economic), with common benefits and synergies in addressing climate change, protecting nature and biodiversity, air quality, water resources and the environment. However, for these policy measures to work and for the objectives to be attained, continued effort and horizontal cooperation will be needed, along with close monitoring for supporting, updating and incorporating new technological developments, while at the same time assessing and adapting to feedback from the market and international developments in addressing climate change.

1.1.2 Overall strategy in relation to the five dimensions of the Energy Union

The EU energy and environmental strategy promotes energy integration in Europe, i.e. the abolition of energy boundaries between national energy markets and the strengthening of the Union's energy security and independence. A key pillar of this strategy is the completion of the internal energy market, which will be liberalised and competitive and will dictate the following steps without intervention, also incorporating the Union's five dimensions. That is, it will provide secure energy to all, facilitate the flow of energy across the EU's internal borders, promote and reward low-carbon economy, while at the same time supporting energy efficiency and new technologies.

Security of energy supply

Given its geopolitical location as Europe's energy gate for new sources of supply from East Mediterranean and Central Asia, plus the potential for developing intra-Community supply sources, Greece can play an important role in Europe's energy transition to a climate neutral economy by 2050. Securing and managing energy resources through diversification of energy sources and flows, with a view to strengthening the security of supply both in Greece and in the broader region of SE Europe, will shield supply to the domestic market and protect consumers in case of supply disruption and emergency. Therefore, the key strategic objective is to ensure the smooth, uninterrupted and reliable coverage of both domestic and regional energy needs, as well as the access of all consumers (people, businesses and public sector bodies) to affordable and secure energy. This will strengthen Greece's regional role in an area that lacks a mature energy market.

Completion of a sustainable energy market

Given the restructuring of its energy sector, Greece aims to develop and operate competitive and economically viable energy markets, which are supposed to function in a way that offers energy products and services to consumers at competitive and transparent prices. Moreover, in a European and global energy-neutral environment, the shift to a low-carbon-intensity energy system will allow new energy technologies to enter the energy market, providing opportunities for innovative investments and activities and strengthening the competitiveness of the Greek economy.

Low-carbon economy

Breakthroughs are expected to occur in the next decade in the field of power supply in Greece, as the RES share in power generation is expected to increase significantly and gradually replace the use of fossil fuels. The policies to be adopted aim at integrating RES in the electricity market in a competitive manner. However, the anticipated reduction in, and ultimate end of, the use of lignite for power generation purposes will have a direct and indirect impact on growth and employment in lignite-producing areas and will be felt by the local communities. Therefore, specific transition policies will have to be developed along with a strategy for financing these policies.

Physical planning

The ongoing urbanisation and expansion of cities, which have been on the rise in recent years, is a common challenge for physical planning in Europe. The rate of consumption of land for urban uses far exceeds the rate of population growth. The primary objective of sustainability policy is a major overhaul of the structure and mode of operation of modern cities. The core issue is promoting the urban models that correspond to urban areas and with respect to the distribution of functions, the density and the hierarchy of their structure (centre, local centres, suburbs). The policies promoted concern changes to the shape, size, density of housing, planning and siting of activities in cities, which will result in changes to the energy demand standard and an overall improvement in their energy and climate footprint.

Bioclimatic town and urban planning

The geometry and siting of buildings, urban roads and public outdoor areas, the use of unsuitable materials on surfaces, the absence of plants, human activities and land uses determine the energy behaviour of an urban area and are responsible for the urban heat island effect and the reduced flow of wind, and therefore for rising temperatures in urban areas both at day and night and increased energy consumption. A key policy objective consists in using bioclimatic design (in town planning and architecture), aiming to bring buildings, roads and public and other spaces in urban areas in harmony with the environment and local climate, which will yield immediate results in terms of energy savings, while at the same time improving the urban environment and quality of life.

Energy efficiency

Improving energy efficiency in all fields of consumption is the biggest challenge for the public policies to be implemented in the following decade. Therefore, it is an absolute and horizontal priority that should cover the entire scope and mix of policies and measures to be adopted. Energy savings achieved through improved energy efficiency have a direct impact on how energy is consumed, on the technologies used and on the coverage of consumer energy needs, also making a substantial contribution towards improving the competitiveness of all industrial activities.

Energy efficiency of buildings

Since buildings are currently responsible for approximately 40% of energy consumption, there is a need to promote the improvement of the energy efficiency of buildings through renovation and modernisation, as well as to adopt corresponding measures for renewing the stock of end-of-lifecycle buildings, while at the same time using construction and demolition waste in conformity to the principles of circular economy. Reducing the energy consumption of buildings requires the increased use of energy-efficient and low-emission heating systems and the renovation or construction of smarter buildings, with improved insulation materials, inter alia, in full conformity to the principles of circular economy. The Energy Performance of Buildings Directive contributes to improved quality of life and makes a significant contribution towards the reduction in GHG emissions by 2050. Another highly important policy is the optimal use of RES technologies to cover heating and cooling needs and of RES autoproduction systems to cover the needs of buildings for electricity, also by strengthening the role of consumers. These actions will ensure a lower cost of living. However, the necessary methods and means must be provided, to help people make this transition.

Mobility

Cities are at the core of the transition to sustainable mobility. Through sustainable town planning (for compact cities and reduced urban sprawl) and by addressing the demands of mobility and infrastructure, cities are called upon to play a pivotal role. Urban areas should move towards digitisation, automation and other innovative solutions and should adopt active and shared modes of transport through increased walking, use of bicycles and micro-mobility vehicles, use of public transport, or even car-sharing and car-pooling (sharing economy).

A crucial area for the transition to a clean, resource-efficient and carbon-neutral future is that of mobility, including all forms of mobility, from urban mobility to trans-European networks, road transport, as well as shipping and air transport. Transport is the primary cause of air pollution, noise, congestion and traffic accidents. The action plan for low-emission mobility, presented by the Commission in 2016, and the 'Europe on the move' proposals that followed contain numerous measures for strengthening the sustainability of the transport system. These actions aim to reduce GHG emissions and launch investment in clean transport. This will also contribute to job creation and growth. We must give priority to clean and affordable alternatives, with the a view to having zero-emission vehicles in the Union's road network and making optimal use of digital technologies that help reduce fuel consumption. Similarly, the Union's satellite navigation systems help reduce emissions, for example in aviation and road transport.

With respect to urban mobility in particular, there must be a shift from the conventional traffic planning used to date, which gave priority to the unhindered movement of vehicles, to human-oriented sustainable urban mobility. This shift will result from integrated and combined town and traffic planning and policies aimed at reducing the use of vehicles, ensuring parking management, and supporting and implementing arrangements and networks for pedestrians, bicycles, micro-mobility vehicles, mass transport vehicles and accessibility.

<u>Transport</u>

In the transport sector, the use of vehicles powered by alternative fuels and electricity, the sharp drop in unit energy consumption per type of vehicle, the use of second-generation biofuels, the complete electrification of railway infrastructure and the increase in the share of track-based modes of transport in the overall transport work will, by the end of the next decade, totally transform the technological structure and fuel mix used in the transport sector, thus impacting the national economy as a whole. Finally, given that Greece is a leader in shipping, it is important to promote emission reduction technologies in shipping in compliance with the decision of the International Maritime Organisation of April 2018 for a 50% reduction in emissions by 2050, compared to 2008, and eliminating emissions by 2100.

Research and innovation

The next decade is deemed to be crucial for the development of innovative technologies and the emergence of start-ups that will help the EU to attain its ambitious objectives. A key parameter for securing the required funds is further integrating the EU energy market and the regulatory and political stability, also enhancing and complementing the framework of policies that have been adopted, without any unpredictable and fragmented moves. In this way, by ensuring the regulatory predictability and necessary competitiveness, the industrial sector will be able to restructure and transform. The market should be able to send a message to research centres that the maturation of technologies which could contribute towards the ambitious EU objectives will be supported either through targeted and time-specific incentives or indirectly such as by ensuring stable and predictable prices for the emissions trading system.

In view of the above, Greek research centres are urged to apply a more open policy that will invite and welcome international partnerships with institutions and other States, avoiding the common practice of participating only in EU-financed programmes.

It should be pointed out that the new planning supports and promotes the strengthening of the role of consumers and the involvement of end-users in the energy market. This can create new jobs and speed up the development of innovative technologies and applications. Moreover, certain new institutions — such as energy communities, active consumers and decentralised energy management — as well as the technological development of electricity distribution networks are expected to play a major role (smart grids).

The 6th dimension of sustainable development

The energy transformation of the Greek energy system, in the context of the commitments and targets that are based on the Paris Agreement, is inseparably linked to the global sustainable development goals (SDGs). These sustainable development goals are associated with the necessary shift to new production and consumption standards, the need for sustainable cities, the elimination of poverty, the establishment of flexible infrastructure, the promotion of sustainable industrialisation, circular economy and the promotion of innovation. The above aims are the components of a sustainable development model which aims to ensure, in addition to fiscal stability, the restructuring of production, the rational use of resources and, primarily, non-discriminate and unhindered access to basic goods and services for all.

Therefore, to implement the new Greek energy policy and attain the relevant energy and environmental objectives, it is necessary to radically transform the energy system over the next decade and, therefore, to implement significant investments in utilising the potential for domestic energy generation, energy networks, interconnections and energy infrastructure in general, as well as energy consumption and management, which will have a major positive impact on growth in Greece.

1.1.3 Policy-making framework and policy priorities

The National Energy and Climate Plan (NECP) lays down national objectives for attaining the EU's Energy Union goals by 2030 which are more ambitious than both those of the initial NECP draft of January, as sent to the EU services for assessment, and the core EU objectives set in the context of the Energy Union. More specifically:

(A) it has set a higher objective for reducing GHG emissions, in order to enable the transition to a climate neutral economy by 2050;

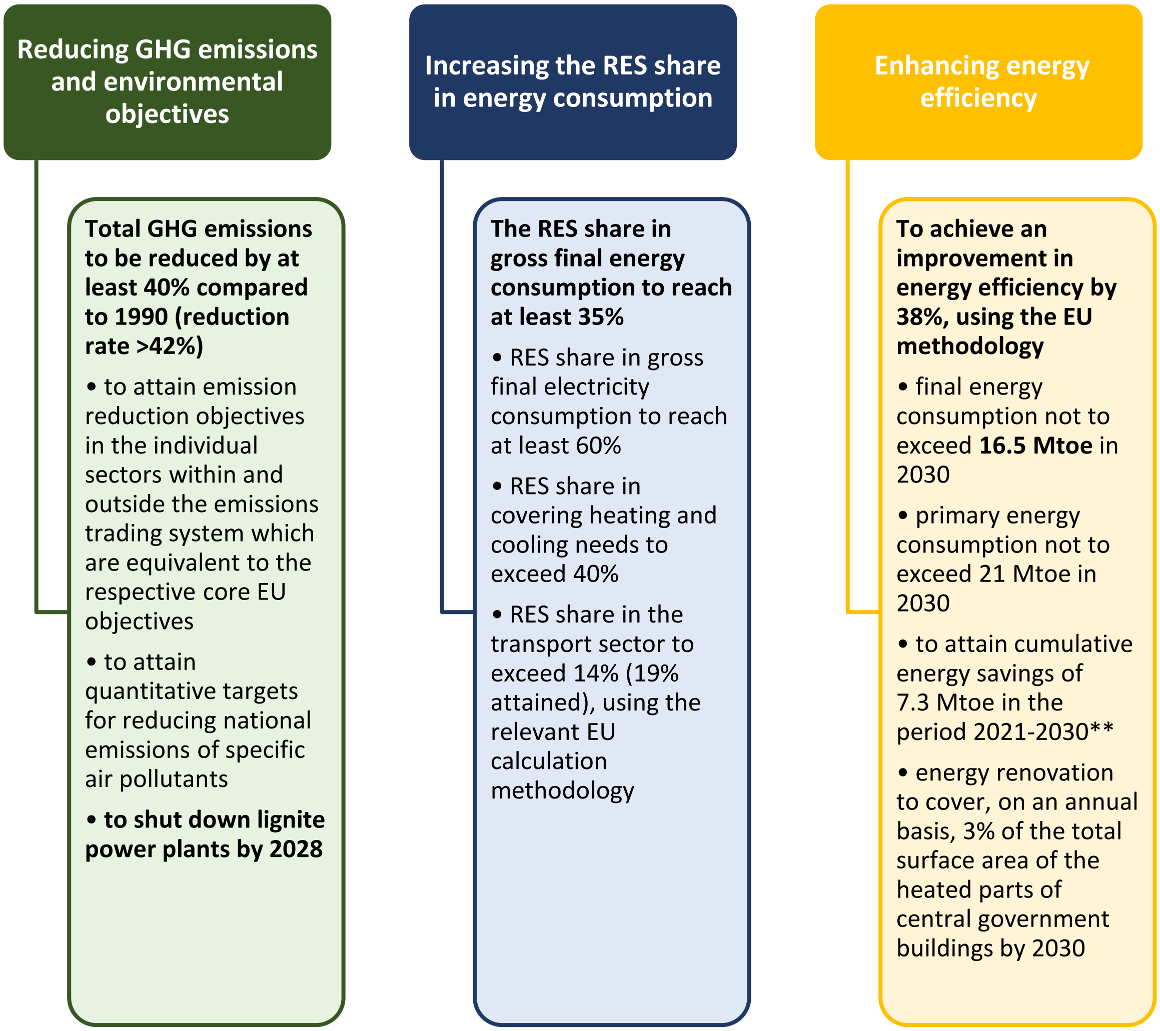
(B) it has increased the objective for RES penetration in gross final energy consumption;

(C) it has strengthened the improvement of energy efficiency by setting a more ambitious energy savings target; and

(D) it has made a commitment for lignite phase-out in power generation, leading to a radical energy sector transformation.

Figure 1 shows the individual quantitative targets in the context of attaining the national energy and environmental objectives for 2030. Please note that account was also taken of the attainment of the corresponding objectives for 2020.

Accordingly, Table 1 lists the key policy priorities for each dimension of the national climate and energy plan, which are deemed necessary for attaining these objectives. These policy priorities are the axes for planning and applying/implementing specific policy measures under each dimension. The overall planning methodology also involves an integrated consultation framework, to have both the definition of objectives and the laying down of policy priorities, as well as the planning and eventual implementation of policy measures evaluated by the organisations and the society in general.



** Without taking into account the contribution of ambient heat*

*** The target has been calculated on the basis of the ex-post final energy consumption data for the period 2016-2017 and the temporary data for 2018*

Figure 1: National energy and environmental objectives for the period 2021-2030 in the context of EU policies.

All these policy priorities and the specific measures required for their implementation are part of an integrated plan for the optimal attainment of the national energy, environmental, socio-economic and development objectives, which requires cohesion, horizontal combination and coordinated monitoring of the priorities and of the implementation of the relevant measures.

A key requirement for attaining the objectives set out in the context of NECP is to understand that the progress made in each individual sector automatically affects that made in the other sectors, and consequently the impact of the measures that are finally planned and implemented does not relate to or affects just one theme and section of the NECP, but has a bearing on the overall development of the energy system and demonstrates that the NECP is also directly linked to other national policies, such as waste management, circular economy and adapting to climate change.

Chapter 3 sets out the policy priorities and measures selected with a view to attaining consistently and effectively the ambitious targets set. The policy priorities and measures were developed by applying the procedure shown in Figure 2.

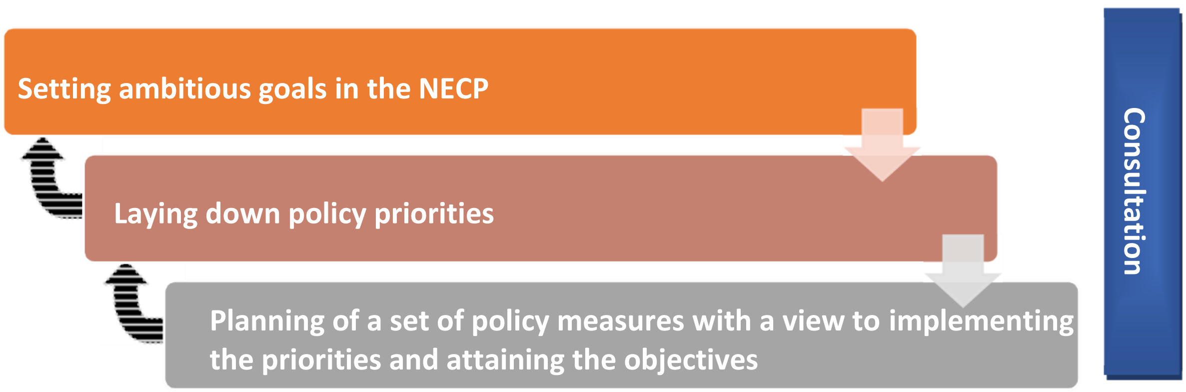


Figure 2: Methodology for planning the policies and measures in the context of the NECP in the period 2021-2030.

More specifically, to attain the national objectives, specific policy priorities were laid down, which must be implemented in the period 2021-2030 by developing targeted policies and measures.

Moreover, a procedure was foreseen for assessing the performance and evaluating the impact of the policy measures, in order to obtain feedback concerning the policy priorities and possibly revise and redefine them with a view to attaining the objectives set.

There is an **objective**, therefore, for a more efficient implementation of the specific policy priorities, which can be ensured by planning and implementing policy measures for each priority separately.

Policy priorities were defined both for the six dimensions of the Energy Union:

- ***Climate change, emissions and removals of greenhouse gases,***
- ***Renewable energy sources,***

- ***Improvement in energy efficiency,***
- ***Energy supply security,***
- ***Energy market***
- ***Research, innovation and competitiveness***, and for new areas of interest:
- ***Agriculture, shipping and tourism***

including the implementation of a horizontal policy priority axis relating to the:

- ***Governance mechanism***

which is deemed to be crucial in ensuring the successful monitoring and, ultimately, implementation of the measures planned and attaining the core national energy and climate objectives laid down in the present NECP.

Therefore, the **policy measures** were proposed taking into account the policy priorities set. It should be noted that the measures do not fully coincide with the priorities, while specific policy measures may lead to different priorities both in one dimension and across different dimensions. That was why particular emphasis was placed on maximising synergies between the different priorities and measures to be implemented across the entire range of the Energy Union.

The policy priorities laid down in the context of the NECP are listed in Table 1, and the following chapters provide details on the policy priorities and measures that will ensure the implementation of the concrete policy priorities.

Finally, please note that the policy measures are often a combination of individual measures and priorities, for which more specific details will be provided gradually in the period 2021-2030 during the implementation of the NECP.

Table 1: Key policy priorities per NECP dimension.

Governance mechanism for the implementation of the NECP, maximising synergies between its cross-sectoral sections
PGA1: Single governance framework
PGA2: Continuity and consistency in the implementation of policy measures by institutional bodies
PGA3: Monitoring mechanism for the implementation and performance of policies and measures
PGA4: Strategic reference framework for development programmes to be planned and

adopted by the network operators and the regulator
PGA5: Development and implementation of financing mechanisms and programmes for the attainment of the objectives
PGA6: Information and training actions for energy transition and addressing climate change
Climate change, emissions and removals of greenhouse gases
PP1.1: Attaining a climate neutral economy, through lignite phase-out, promoting RES in Greece’s energy mix and interconnecting the autonomous island systems
PP1.2: Actions for adapting to climate change
PP1.3: Actions for reducing emissions in the transport sector
PP1.4: Actions for reducing emissions of fluorinated gases
PP1.5: Actions for reducing emissions in the agricultural sector
PP1.6: Waste management strategy plans
PP1.7: Circular economy strategy plans
PP1.8: Urban bioclimatic restructuring and smart cities
PP1.9: Involvement of the financial sector
PP1.10: Actions for reducing emissions in the industrial sector
Renewable energy sources
PP2.1: Coverage of domestic electricity consumption mainly from RES
PP2.2: Reform of the licensing and physical planning framework, speeding up and effectiveness of licensing
PP2.3: Participation of RES plants in the electricity market without operating aid
PP2.4: Promoting dispersed RES systems and strengthening the participation of local communities and consumers
PP2.5: Ensuring the viability and liquidity of the operating support scheme for RES power plants
PP2.6: Development and reinforcement of energy networks and optimal integration and operation of RES plants
PP2.7: Statutory obligations for a minimum RES share in covering the energy needs of buildings
PP2.8: Strengthening the use of RES systems for covering thermal and cooling needs

PP2.9: Coupling the energy sectors to ensure maximum utilisation of domestic potential by RES and promoting new technologies
PP2.10: Promoting the use of advanced biofuels in the transport sector
PP2.11: Promoting electromobility
Improvement in energy efficiency
PP3.1: Improvement in energy efficiency of public buildings and exemplary role of public sector, improving microclimate in urban public space
PP3.2: Strategy for renovation of the building stock in the residential and tertiary sector
PP3.3: Promoting energy efficiency contracts by energy service companies
PP3.4: Promoting market mechanisms
PP3.5: Promoting innovative financial instruments to ensure private capital leverage and financial sector involvement
PP3.6: Improvement in energy efficiency and competitiveness of the industrial sector
PP3.7: Framework for the replacement of polluting passenger vehicles and goods vehicles
PP3.8: Developing infrastructure and plans for a shift in transport operations
PP3.9: Energy efficiency improvement of electricity and gas infrastructures
PP3.10: Promoting measures for modernising water supply / sewage and irrigation infrastructures
PP3.11: Promoting efficient heating and cooling
PP3.12: Training/informing professionals and consumers on energy-efficient equipment and rational use of energy
Security of energy supply
PP4.1: Increasing diversification of energy sources and import routes
PP4.2: Highlighting Greece's profile as a regional energy hub
PP4.3: Reducing energy dependency and developing domestic energy sources
PP4.4: Promoting flexibility, storage and response systems and ensuring Greece's power adequacy
PP4.5: Readiness of Greece and of the bodies involved to cope with constrained or interrupted supply of an energy source
Energy market
PP5.1: Strengthening electricity and gas interconnectivity with neighbouring countries

PP5.2: Promoting electricity transmission, distribution and storage projects
PP5.3: Promoting gas transmission, distribution and storage infrastructure projects
PP5.4: Digitisation of energy networks
PP5.5: Strengthening competition in electricity and gas markets
PP5.6: Measures for the development of electricity and gas networks
PP5.7: Adjustable charges based on cost-effective incentive mechanisms
PP5.8: Integrated development plans, investment actions and financing programs for lignite-producing areas undergoing a transition
PP5.9: Protecting consumers and addressing energy poverty
Agriculture, shipping and tourism
PPN.1: Promoting infrastructure for the use of natural gas
PPN.2: Handling and utilising agricultural and livestock residues
PPN.3: Promoting the use of RES and energy efficiency improvement actions in ports
PPN.4: Developing domestic production of advanced biofuels and supply chains for their use
PPN.5: Promoting the use of RES and energy efficiency improvement actions in the agricultural sector
PPN.6: Sustainable tourism development and destination management plans
PPN.7: Promoting the use of RES and energy efficiency actions in tourist complexes
Research, innovation and competitiveness
PP6.1: Innovative applications with a high potential for domestic added value and strengthening of openness of enterprises
PP6.2: Development of innovative energy-saving technologies
PP6.3: Development of innovative decarbonisation technologies
PP6.4: Smart grids
PP6.5: Development of innovative technologies in transport and applications for micro-mobility
PP6.6: Development of innovative energy storage applications and of CO_2 capture, storage and use technologies
PP6.7: Promoting innovative technologies to support circular economy actions

PP6.8: Implementing horizontal measures to improve the conditions for research
PP6.9: Promoting entrepreneurship through research and innovation actions which are part of market functions
PP6.10: Optimising support framework and schemes for promoting investment with a view to strengthening competitiveness
PP6.11: Strengthening competitiveness by setting up and operating special funds

1.2 Consultation and involvement of national and EU bodies

1.2.1 Participation of the Hellenic Parliament

Four consultations have already taken place in the Hellenic Parliament on the National Energy and Climate Plan.

Firstly, presentations were made concerning the necessity of drawing up the NECP and the relevant objectives to be set.

During the first consultation in particular (27 February 2018), a presentation was made about the Governance Regulation and Greece's obligations in the field of energy and the environment and the proposed mechanism for drawing up the plan. During the second consultation (29 March 2018), a detailed description was given of the quantitative objectives per policy axis and of the additional energy, environmental, social and economic objectives of the plan, as well as of the organisational structure of the plan implementation mechanism.

Finally, during the third consultation (23 January 2019), the completed text of the initial NECP draft was presented to the Parliament, with reference to the 2030 energy and climate policy objectives, a description of the measures and policies envisaged to achieve the relevant energy and climate objectives, as well as the amount of investment required to attain these objectives.

Eventually, on 13 December 2019, a joint meeting of the relevant committees was held in the Hellenic Parliament, where the final objectives, priorities and policy measures of the final NECP draft were presented and then the committee members made their comments on the NECP objectives, priorities and measures, which were discussed extensively.

Consultation with stakeholders, including the social partners, the civil society and the general public, were carried out at different stages of the process of drawing up the NECP.

1.2.2 Getting local and regional authorities involved

A workshop was held on 18 June 2018 with regional and municipal local authorities, attended by 86 representatives of municipalities and regions. Also, a questionnaire was enclosed in the invitation to the workshop, including questions on the regional dimension of the energy and climate plan, as well as the obstacles and challenges associated with its implementation.

1.2.3 Consultation with stakeholders, including social partners, and involvement of civil society and the general public

I. A workshop was held on 2 April 2018 with institutional bodies, market players and NGOs, entitled 'Goals and challenges of national energy planning'. The purpose of the workshop was to present measures and policies that could contribute to the attainment of energy, environmental and socially related objectives that would contribute to the economic growth of Greece, the protection of Greek consumers and the attainment of the core objective of adopting a sustainable national energy development model.

   The workshop was attended by 114 participants, including 33 representatives of unions and associations, 10 universities / research centres, 27 representatives of companies and NGOs, 35 representatives of energy and environmental stakeholders, 5 representatives of the press and 4 other natural persons.

   In the framework of the workshop, a questionnaire was prepared and sent to the participants asking for proposals regarding the objectives, measures and policies that should be correlated to the issues of national energy planning for the period up to 2030. The aim of the consultation was to provide a complete inventory of the proposals regarding the objectives and measures that should be put in place and implemented accordingly in the Greek territory within the context of the National Energy Planning.

II. A press conference was held on 20 November 2018, where the Energy and Climate Plan and its quantitative objectives were presented, which was attended by numerous representatives of the printed and electronic press[1].

III. A workshop entitled 'Research, innovation and competitiveness in the energy and decarbonisation field' was held on 29 November 2018. The aim of the workshop was to submit proposals within the context of the consultation on national priorities and policies for a decade in the areas of research, innovation and competitiveness in the field of energy

[1] http://www.ypeka.gr/Default.aspx?tabid=389&sni[524]=5976&language=el-GR

and environment, in order to keep pace with the cutting-edge technologies and at the same time to combine financial opportunities and capabilities, and also to update the institutional requirements.

A total of 171 participants attended the workshop, including 30 representatives of companies, 20 representatives of universities, 16 research and innovation organisations, 16 representatives of public and private bodies, 30 CRES partners and 59 other natural persons. A workshop is being planned along the same lines, to be attended broadly by the general public, where the final Energy and Climate Plan will be presented.

IV. The initial draft of the Energy and Climate Plan was posted on a consultation website for regulatory texts for a period of 24 days, from 13 November to 7 December 2018. A total of 868 comments were made, including 19 by unions/associations of stakeholders, 10 by civil society organisations, 7 by companies active in the energy sector, 6 by universities / research centres and 826 by natural persons.

V. In the period from September to November 2019, meetings were held with market unions and players active in the fields of renewable energy sources, energy product supply and energy generation with respect to the planning of policy measures in the context of the NECP and the revised national energy and climate objectives for 2030.

VI. The bodies invited to and participating in the Inter-Ministerial Committee for the NECP submitted their proposals from 14 to 20 November 2019 on the recommended policy priorities and the measures planned, and they submitted and presented their definitive proposals on the final NECP draft in a relevant meeting held on 13 December.

VII. The final Energy and Climate Plan was posted on a consultation website for regulatory texts from 28 November to 16 December 2019. In the context of that final public consultation, a total of 175 comments on the text of the draft and 7 comments on the annexes were made, including 57 of them by unions / associations / collective organisations and 118 by natural persons.

VIII. An open event was held on 2 December 2019, supported by the Bank of Greece, where the final NECP draft put to public consultation was presented, and then the proposals were presented to, and discussed by, those attending the event. The above event was attended by 148 representatives of public and private market players, local authorities, collective bodies, academic organisations and research centres.

Annex E summarises the results of the public consultation carried out in connection with the NECP over a total period of 19 days and quantitative data from the comments incorporated and taken into account in drawing up the final NECP draft. An accompanying note is also provided on incorporating the feedback from the public consultation in the NECP.

There are also plans for preparing special environmental impact assessments in the following period, upon completion and adoption of special frameworks for the implementation of projects, strategic plans and programmes with a view to incorporating environmental approvals and promoting sustainable development.

Consultation with other Member States

Targeted contacts were made on the basis of the specific priorities and objectives per theme, as described in the next section.

1.2.4 Regional cooperation in drawing up the plan

During the process of drawing up the National Energy and Climate Plan, account was taken of active/existing and ongoing regional collaborations on energy and climate issues in order to assess any synergies and specific actions that can contribute to the attainment of the national energy, environmental and other objectives of the NECP.

In this context, the following information is reported:

Greece-Cyprus-Jordan

A Memorandum of Understanding (MoU) for cooperation in the fiend of RES was entered into on 16 January 2018 by and between the Ministry of the Environment and Energy of the Hellenic Republic, the Ministry of Energy, Commerce, Industry and Tourism of the Republic of Cyprus and the Ministry of Energy and Mineral Resources of the Hashemite Kingdom of Jordan.

The purpose of the cooperation on the basis of the above MoU is the exchange of information and know-how, policy-making, training and actions for RES, energy efficiency, innovation and research, as well as the exchange of knowledge, best practices and pilot projects in buildings, focusing in particular on promoting near-zero energy buildings and incorporating RES.

Greece-Cyprus-Israel-Italy

An MoU for cooperation in the context of the EastMed gas pipeline was entered into on 5 December 2017 by and between the State of Israel, the government of the Republic of Cyprus, the government of the Hellenic Republic and the government of the Italian Republic.

The purpose of the above MoU Memorandum is to confirm the parties' intent to cooperate in the development and implementation of the EastMed pipeline project as a viable and strategic choice for the natural gas producing countries, given that it will serve as a direct and long-term gas export route to Greece, Italy and other European markets and will strengthen the EU's security of supply while at the same time promoting competition between natural gas suppliers.

Greece-Cyprus-Israel

A joint declaration was signed in Israel on 20 December 2018 by and between Greece, Cyprus and Israel in the context of the 5^{th} summit, focusing, inter alia, on the completion of intergovernmental cooperation for the EastMed gas pipeline. The declaration stressed in particular the three parties' commitment to implement the EastMed pipeline project, their support for the 'Euro-Asia Interconnector' project, and the expansion of their cooperation in the field of RES, alternative fuels, electric vehicles, strengthening innovation and joint implementation of pilot projects. After a decision was made to implement the electrical interconnection of Crete as a national project (Ariadne Interconnection), aiming to secure the energy adequacy of Crete in a timely manner, Greece has supported the implementation of the Crete-Cyprus-Israel electrical interconnection project.

Greece-Cyprus-Egypt

A joint declaration was signed in Cairo on 8 October 2019 by and between Greece, Cyprus and Egypt in the context of the 7^{th} summit, whereby the three parties agreed to intensify their cooperation by entering into a number of agreements for the exploitation and transit of natural gas, pointing out that the discovery of deposits can contribute greatly to security and prosperity in the region.

Greece-Germany

In the context of the TARES ++ (2013-)/SRRS (Structural Reform Support Service) project, the cooperation in the field of RES and energy efficiency in Greece was intensified in terms of policies and measures, and steps were taken to develop new initiatives in the above fields, as well as in the fields of electricity systems, electricity storage and electromobility, focusing on innovative technologies and best practices.

Greece-Italy

A joint declaration was signed in Corfu on 14 September 2017 by and between Greece and Italy in the context of the Conference of the Minister for the Environment and Energy of the Hellenic Republic and the Minister for Economic Development of the Republic of Italy.

An MoU was signed in Rome on 26 November 2019 by and between the competent ministries for strengthening energy cooperation between the two countries.

Central and South Eastern Europe Energy Connectivity – CESEC

An MoU was signed in Dubrovnik on 10 July 2015 on a joint approach to address the natural gas diversification and security of supply challenges in the CNECP Initiative countries.

A MoU was signed in Bucharest on 28 September 2017 complementing the CESEC Initiative for Central and South Eastern Europe in respect of the joint approach on electricity market, energy efficiency and RES development.

With regard to RES in particular, the cost-competitive renewable energy potential and the added value of RES for the development of a cost-effective, low-carbon energy system and job creation in the CESEC Initiative countries are recognised. In this context, please note the importance of stable and effective conditions for the cost-effective development of renewable energy sources, including the impact of capital costs, and the need for further integration of RES into the market, system and network.

Emphasis is also placed on the development of long-term strategies and plans, such as national energy and climate plans to explore options for further cooperation in their preparation and definition.

Other cooperation measures

- Participation in CA-EED, CA-EPBD and CA-RES groups on RES and energy efficiency.
- Participation in ENTSO-e meetings on energy infrastructure market and development issues.
- Participation/cooperation of CRES as the national centre for RES in the European Energy Network (EnR) and the Mediterranean Association of National Agencies for Energy Management (MEDENER).

Specific partnerships on research, innovation and competitiveness issues

In the context of long-term cooperation and ongoing bilateral scientific and technological (S&T) cooperation agreements with other countries, the Secretariat-General for Research and Technology (SGRT) is launching joint calls for S&T projects. The calls announced involve the submission of proposals for the implementation of bilateral S&T cooperation projects also in the energy sector. The proposals submitted involve areas of mutual interest in the energy sector which have been developed through consultations with the competent bodies of the partner countries and are compatible with the strategic areas of research, technological development and innovation (RTDI) and the thematic priorities set out in the National Strategy for Smart Specialisation (RIS3) 2014-2020.

1.3 National and Union energy system and policy framework of the national plan

The national energy and climate policy framework is governed by the respective Union framework, and a sufficiently broad national regulatory and statutory framework has been developed for its implementation. This framework is updated within the dimensions of the national plan by taking into account its operating results and the developments occurring at national, regional and European levels. The basic regulatory and statutory framework of the NECP, the administrative structure for implementing national energy and climate policies, and the existing policies and measures within the dimensions of the Energy Union are presented in Annex A to the NECP.

Chapter 2 NATIONAL OBJECTIVES AND TARGETS

2.1 Overview of final NECP objectives and comparison against the initial draft

The Greek government intends to use the NECP as the ***key tool for developing its national energy and climate policy for the following decade***, taking into account the **Commission's recommendations** and the **UN sustainable development goals.**

The NECP will be used to identify Greece's priorities and development capabilities in terms of energy and addressing climate change, and provision has been made for a specific **roadmap for attaining specific quantitative and qualitative objectives, which will outline policy priorities and measures in a wide range of development and financial activities for the benefit of the society**.

The government's core energy and climate objectives and priorities, which are taken into account in drawing up and implementing the NECP, consist in attaining the following:

- an integrated model for sustainable and viable growth in all economic sectors;
- combined energy sector development and environmental protection through bold measures for addressing climate change;
- choosing energy policies with the most cost-benefit ratio for energy transition;
- waste management and utilisation by the use of state-of-the-art circular economy technologies;
- transforming Greece into an energy hub with a strong contribution to the EU's energy security and security of supply;
- ensuring the strategic diversification of energy imports, while at the same time modernising and developing energy infrastructures and putting an end to the energy isolation of the islands;
- setting up attractive investment environment to support energy transition, focusing on innovation and new technologies;
- ensuring the maximum possible use of community resources and mechanisms; and
- ensuring openness and innovation in order to achieve growth that will create new jobs.

In view of the above, the main objective of the National Energy and Climate Plan is to design, plan and implement socially and environmentally efficient and cost-effective policy measures that will help attain the medium- and long-term national energy and climate objectives, will contribute to economic growth in Greece and will also respond to the challenge of reducing energy costs and, in general, of protecting end users from high prices of energy products and services.

These national energy and climate targets for 2030 are developed by taking into account both specific quantitative obligations undertaken by Greece as a Member State (i.e. targets for non-ETS sectors and for the reduction of national emissions of certain air pollutants compared to 2005) and the characteristics and specificities of our national energy system, the domestic potential for developing technologies and applications, the potential for adaptation, as well as Greece's socio-economic characteristics. This process results in adapting the national objectives to the corresponding core EU ones (i.e. the objectives for sectors that are part of the emissions trading scheme, RES, energy savings), which are finally proposed under this national plan.

Furthermore, the main quantitative policy objectives set in the context of the national energy plan for the period up to 2030 are also 'intermediate' objectives for reducing GHG emissions by 2050, given that the ***Greek government aims to participate in the commitment for a climate neutral economy at an EU level.***

More specifically, the Government is revising the objective for **the RES share in gross final energy consumption** by 2030 from 31%, as stated in the initial NECP draft, **to at least 35% by 2030**. Please note that the current RES share in gross final energy consumption is approximately 18%[2].

As regards power generation in particular, RES will be the major domestic source of power as early as in the middle of the following decade, with a share exceeding **65% of the domestic power generation** by 2030 and 60% of the gross final electricity consumption, by utilising in the most cost-effective manner Greece's high potential especially for wind and photovoltaic plants. A tool in this direction will be the full functioning of the new electricity market model, the simplification and speeding up of the licensing procedure, the digitisation of the energy system and the enhancement and expansion of energy infrastructures to allow for maximum RES penetration in power generation, focusing on storage systems, and in general the gradual

[2] 16.95% in 2017 on the basis of the latest official statistics and a current estimated share ≈ 18%.

electrification and the energy coupling of final consumption sectors to allow for maximum RES share in final energy consumption. Another priority is promoting electromobility, which will now rely heavily on RES power generation, while at the same time ensuring considerable energy savings through improved energy efficiency. The NECP and the strategic plan for promoting electromobility, which is also an energy priority for the government, also fall in this context.

The aim is also to put an end to the **energy isolation of our islands** by early 2029 at the latest and to have them interconnected with the mainland system, thus eliminating the utility services costs, as well as to have innovative hybrid RES power generation systems set up on those islands that will not be interconnected or will be interconnected later on, for the benefit of all consumers. At the same time, further using RES to cover thermal and cooling needs, in buildings in particular, promoting dispersed RES generation and advanced biofuels in transport are some of the priorities laid down in the NECP, and specific targets are being set in that context.

As far as **improved energy efficiency** is concerned, it should be stressed that it is a core horizontal priority and is essentially the first axis on which all other policies are planned, given that it is a necessary condition for implementing the policies through specific measures in an economically and socially optimal manner in all final areas of consumption and themes.

Moreover, improving energy efficiency is a key horizontal priority with multiple benefits, such as reducing GHG emissions, cutting down on energy costs, ensuring better comfort conditions in buildings and in public spaces, increasing added value and employment and improving the competitiveness of businesses.

As far as the **energy efficiency improvement** objective is concerned, the government's aim is to implement an optimal combination of regulatory interventions and financial instruments in order to allow for utilising the potential for energy savings and making sure that final energy consumption in 2030 is limited to the 2017 levels[3] and is much lower than the corresponding target for 2020[4]. The performance in respect of the above two indicators, which are the indicators used to assess Member States for this dimension, will ensure the attainment of the **energy efficiency improvement objective of 38%** in relation to the methodology used for the core EU objective.

[3] Reduction of 1.5% - 3.6% based on the results of the two energy simulations.
[4] Reduction of 10.3% - 12.2% based on the results of the two energy simulations.

To attain this objective, specific measures are being planned for buildings with a view to implementing an ambitious plan for the renovation and improvement of the energy efficiency of the stock of public buildings through the participation of energy service companies (ESCOs) and the renewal of end-of-lifecycle buildings. Plans are also being made for providing targeted incentives for energy efficiency improvement interventions in the stock of private buildings by adopting an ambitious strategy for the renovation of the building stock in its entirety, to make sure that 12-15% of the buildings have undergone energy renovation by 2030. Similarly, measures are being planned for the industrial and transport sectors, focusing on specific energy consumptions and uses for which energy efficiency improvement and energy savings actions with a high cost-effectiveness per energy benefit unit ratio can be implemented, along with a change to the urban mobility model, consisting in reducing the use of private vehicles and increasing 'soft' forms of transport.

Special measures and incentives are also being planned for the bioclimatic upgrade of the urban public space in order to reduce the urban heat island effect by 20% by 2030.

Another priority consists in the optimal use of available public and private financial instruments with a view to ensuring maximum benefits for final consumers, taking due account of the specificities of each category of final consumers and of the characteristics of the energy interventions considered as optimal.

A major objective in the context of the new revised government strategy for the NECP is the highly ambitious, as well as realistic, programme for sharply and definitively reducing the share of lignite in power generation, i.e. the so-called **lignite phase-out**, by implementing a relevant front-loaded programme in the following decade, also given that all the lignite-fired thermal power plants currently in operation are to be shut down by 2023, and **putting a complete end to the use of lignite for power generation in Greece by 2028**. This objective also incorporates the government's vision to address environmental protection issues in the long run and rationalise power generation costs in Greece now.

The lignite phase-out plan for power generation in Greece also involves adopting integrated programmes for supporting lignite-producing areas in Greece, to smooth out the transition to the post-lignite era. More specifically, the Greek government has been committed to shutting down lignite-fired plants by 2028 in a well-coordinated and responsible manner. Maintaining jobs and utilising the increased know-how of human resources in these areas are a top priority.

Clearly, these revised quantitative energy objectives of the NECP will consequently contribute to a further reduction in GHG emissions by 2030 and will make Greece stand out as one of the Member States that have adopted ambitious climate objectives. Moreover, a core objective in the context of the revised NECP consists in attaining a **GHG emission reduction of more than 56% compared to 2005,** against a corresponding EU objective of approximately 36% (adjustment of the EU objective of 40% compared to 1990).

Through its long-standing strategy, the government has supported the effort made towards a climate neutral economy, aiming to improve the competitiveness of the economy and of businesses, to create new jobs and to strengthen the role of consumers and the overall functioning of competitive energy markets for the benefit of society.

Table 2 summarises the revised and more ambitious national objectives both compared to those of the initial NECP draft and the corresponding EU ones.

Table 2: Summary of national objectives in the context of the NECP.

Year of objective: 2030	Final NECP	Initial NECP draft	New NECP objectives compared to EU objectives
RES share in gross final energy consumption	**≥35%**	**31%**	**More ambitious than the corresponding core EU objective of 32%**
RES share in gross final electricity consumption	**≈61-64%**	**56%**	
Final energy consumption	**≈16.1-16.5 Mtoe** **(≥38% compared to the 2007 predictions)**	**18.1 Mtoe (32%)** (referring to 17.3 Mtoe without ambient heat)	**More ambitious than the corresponding core EU objective of 32.5% and attainment of the objective on the basis of a new EU indicator for reducing consumption compared to 2017**
Share of lignite in power generation	**0%**	**16.5%**	
Reduced GHG	**≥42% compared to 1990, ≥56% compared to 2005**	**33% compared to 1990, 49% compared to 2005**	**Identical with core EU objectives and overperformance compared to national commitments in non-ETS sectors**

Another priority of the NECP in terms of policies planned and of the implementation of specific measures is to attain specific objectives regarding the security of energy supply, the functioning of energy markets and the role of consumers, to strengthen the competitiveness of the economy and to promote research and innovation actions.

In this context, other individual national objectives are also being developed on the basis of specific thematic policy axes, taking due account of the individual potential, technical specificities and qualitative characteristics of the Greek energy system in the fields of energy generation, distribution and consumption and the overall structure of the Greek economy.

These qualitative objectives are broken down into the following key categories:

1. **Objectives to strengthen interconnectivity and security of energy supply.**

2. **Objectives and timetables for liberalised and competitive energy markets.**
3. **Objectives and timetables for the optimal development and functioning of the energy system and energy infrastructures for the benefit of users.**
4. **Objectives of protecting and strengthening the role of consumers.**
5. **Objectives of changing consumption patterns and using energy-efficient and low-emission fuels in final consumption sectors.**
6. **Objectives of strengthening the competitiveness of the national economy.**
7. **Objectives of promoting research and innovation in environmental and energy issues.**

It should be pointed out that a necessary horizontal condition for attaining all these objectives and priorities of the energy plan is to mobilise significant investment funds both from the private and public sector and to combine the use of specialised financing mechanisms and market mechanisms to allow for the cost- and time-effective implementation of the measures and policies planned in terms of specific projects and interventions.

The following chapter sets out the key policy priorities for each dimension of the National Climate and Energy Plan, which are deemed necessary for attaining these objectives. These policy priorities are the axes for planning and applying/implementing specific policy measures under each dimension.

All these policy priorities and the specific measures resulting from their implementation are part of an integrated plan for the optimal attainment of the national energy, environmental, socio-economic and development objectives, which requires consistency, horizontal combination and coordination in monitoring the priorities and implementing the measures.

2.1.1 Revised NECP: Ambitious and realistic objectives

This section compares the results of the initial National Energy and Climate Planning (NECP) draft published in January 2019 against those of the final NECP draft, which incorporates the latest political commitments. The new modified objectives lead to a new forecast of the development of the energy system, with different results in terms of the structure and share of fuels and technologies.

Table 3 shows the evolution of the key energy system values for 2030 for either resolution by the use of suitable energy models. The results that are based on the revised objectives of the final NECP for 2030 are marked with higher RES penetration shares in gross and final energy consumption, a greater energy efficiency improvement that translates into lower forecasts of final energy consumption, and a zero share of lignite-fired plants in power generation. A more detailed description of these differences is given in the graphs below in this section.

Table 3: Comparison of the key energy system results for 2030, between the original and final NECPs.

Comparative table	Initial NECP	Final NECP
Core indicators		
Total GHG emissions ($MtCO_2eq$)	71	60.6
RES share in gross final energy consumption [%]	31%	35%
RES share in final consumption for heating and cooling [%]	32%	43%
RES share in gross electricity consumption [%]	56%	61%
RES share in final consumption for transport [%]	20%	19%
Energy productivity [EUR million '10/ktoe]	9.98	11.03
Energy consumption		
Gross domestic consumption	23.02	22.19
Primary energy consumption [Mtoe]	22.26	20.55
Final energy consumption [Mtoe]	18.04	17.38
Final energy consumption (without ambient heat) [Mtoe]	17.32	16.51
Power generation		
Installed capacity [GW]		
Lignite	2.70	0.00
Natural Gas	5.40	6.91
Wind farms	6.60	7.05
Photovoltaics	6.80	7.66
Total installed RES capacity for power generation	17.70	19.03
Gross power generation [TWh]	57.37	57.93
Net power generation [TWh]	55.56	57.22
Lignite	9.03	0.00
Petroleum products	1.54	0.83[5]
Natural Gas	10.26	18.30
Bioenergy	1.74	1.58
Hydro	6.27	6.60
Wind farms	15.51	17.21
Photovoltaics	10.34	11.82

[5] It concerns almost exclusively power generation in the energy sector, refineries in particular

Solar thermal	0.26	0.26
Geothermal	0.63	0.63
Net power generation from fossil fuels [TWh]	20.80	19.13
NET electricity imports [TWh]	4.16	4.58
Total electricity supply [TWh][6]	59.72	61.80
Final electricity consumption [TWh]	54.32	56.4
Buildings		
Total number of residential buildings renovated by 2030	400,000	600,000

With regard to the share of the RES in the energy system, the revised NECP has provided for a much higher RES share in the energy system, both overall and in individual sectors. This significantly higher RES share results from new policy measures and from the commitment to gradually reduce the use of lignite-fired plants for power generation up until they are all shut down by 2028. This decision creates space for the installation of additional RES plants, also strengthening the role of the gas-fired plants that will provide the necessary system flexibility.

The additional output of gas-fired and RES plants compared to lignite-fired plants also has an impact on overall GHG emissions, which will decrease by a significant 17%. There is also reduced own-consumption in power generation, as RES plants, typically replacing lignite-fired plants, have significantly lower own-consumption levels.

This plan presents a further improvement in energy efficiency and ultimately a reduction in final energy consumption of about 3.6% - 4.7% compared to the objective set in the initial NECP, depending on the methodology used. Please note that, as also explained in the chapter that contains the detailed results, the forecast of the energy system development with the second energy model used, in addition to the first one that had been used in the initial NECP draft, also includes an even higher estimated contribution of the policy measures planned towards energy efficiency improvement and a final consumption reduction rate of over 6.5%. In this respect, particular emphasis will be placed on measures for the energy upgrading and renovation of the building stock in the scenario for attaining the objectives.

[6] The total electricity supply is defined as the sum of the net power generation and net electricity imports.

More specifically, the total number of buildings or building units to be renovated by 2030 is expected to reach 600 000, compared to an estimated 400 000 in the initial NECP draft.

More specifically, it should be noted that, if ambient energy used by heat pumps and considered as RES is not taken into account for the calculation of final energy consumption (according to the method used to calculate the relevant balances by 2016), the energy savings achieved are 4.7% higher than those of the initial NECP draft.

Finally, as far as the transport sector and the RES share are concerned, this draft has, at an energy simulation level, retained a high estimate of the Greek data relating to the share of electromobility in passenger transport, but has set a new more substantial objective with respect to the share of electric passenger vehicles in new registrations in 2030.

More specifically, taking into account the detailed description of the characteristics and capabilities of the domestic market in passenger cars, as detailed in Chapter 3, and the assumptions taken into account in the energy model simulations, a new objective has been set in the context of the NECP for a **30% share of electric passenger vehicles in new registrations in 2030.** This objective, as detailed in following sections, is still ambitious, but also realistic if we take into account the actual data of the domestic market in vehicles. It should be stressed that, to ensure the completeness of the policies described, intermediate targets are also set in terms of the share of electric vehicles in new registrations, which were not included in the initial NECP draft (described in Chapter 3), thus establishing a more thorough and detailed approach to promoting electromobility, on the basis of realistic assumptions of the domestic market.

The aim is to monitor the development of the domestic market in electric vehicles on the basis of the measures and incentives described in the respective section of Chapter 3, with a view to using the actual share of electric vehicles in new registrations as a basis for revising the results of energy simulations with regard to the share of electric vehicles in the entire fleet of passenger vehicles.

An additional aim is to reduce the use of private vehicles (in urban areas in particular) and replace it with the use of public transport, bicycles, micro-mobility vehicles and walking.

The following graphs and tables show the results of the two approaches to: (i) the shares of RES in final consumption both in the key sectors and overall, (ii) the formulation of the power generation mix, (iii) the resulting emission reduction levels, and (iv) the comparative evolution of final energy consumption and the breakdown of the absolute and weighted increase in energy efficiency improvement, as well as a comparison of the use of fuels in final energy consumption. As regards RES shares for 2030, percentage values in this draft are significantly increased compared to those of the initial draft (Chart 1). More specifically, an objective for a 35% RES share in final consumption leads to an increase in shares by 33% in heating and cooling and by 9% in gross electricity consumption, where a share of at least 61% is expected.

There is a significant difference observed in the results of the two approaches in respect of the forecast of the total GHG emissions for 2030 (Chart 2).

More specifically, the revised plan contains a forecast of 60.6 $MtCO_2eq$ of total GHG emissions, compared to a forecast of 71 $MtCO_2eq$ in the initial draft. In fact, the decrease compared to 1990 and 2005 is almost 43% (42.6%) and 56%, respectively. This difference reflects the diversification of the energy mix, i.e. an increase in the use of RES and gas-fired plants and a reduction in the use of diesel-fired plants and the shutdown of lignite-fired plants.

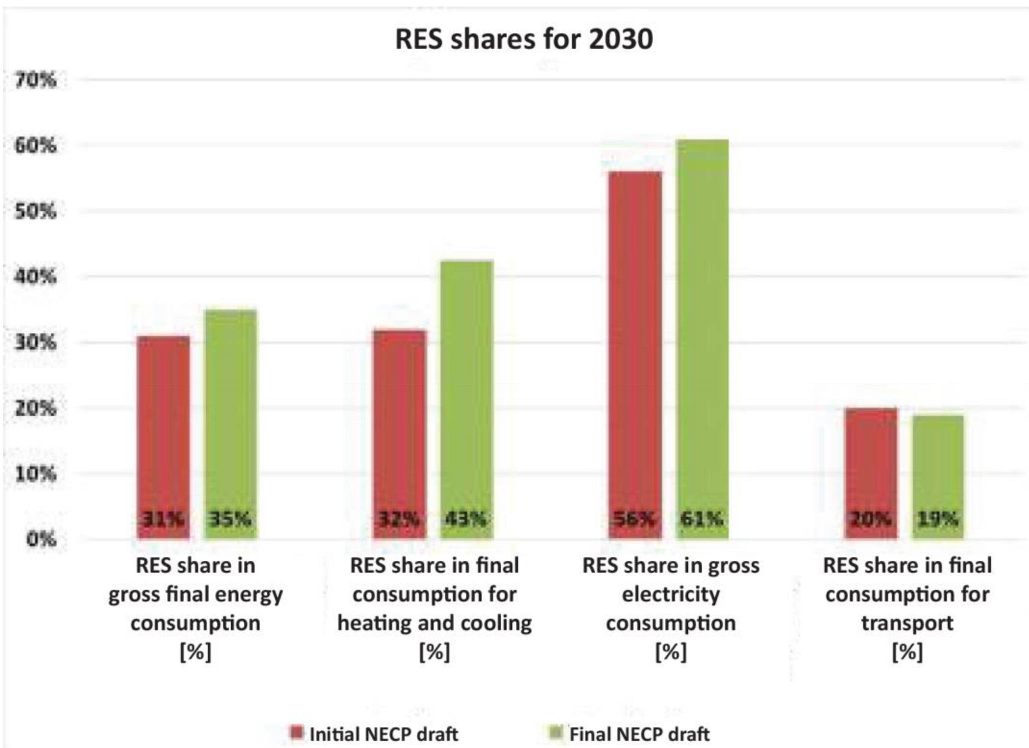


Chart 1: Comparing the share of RES plants for 2030, between the initial and final NECP drafts.

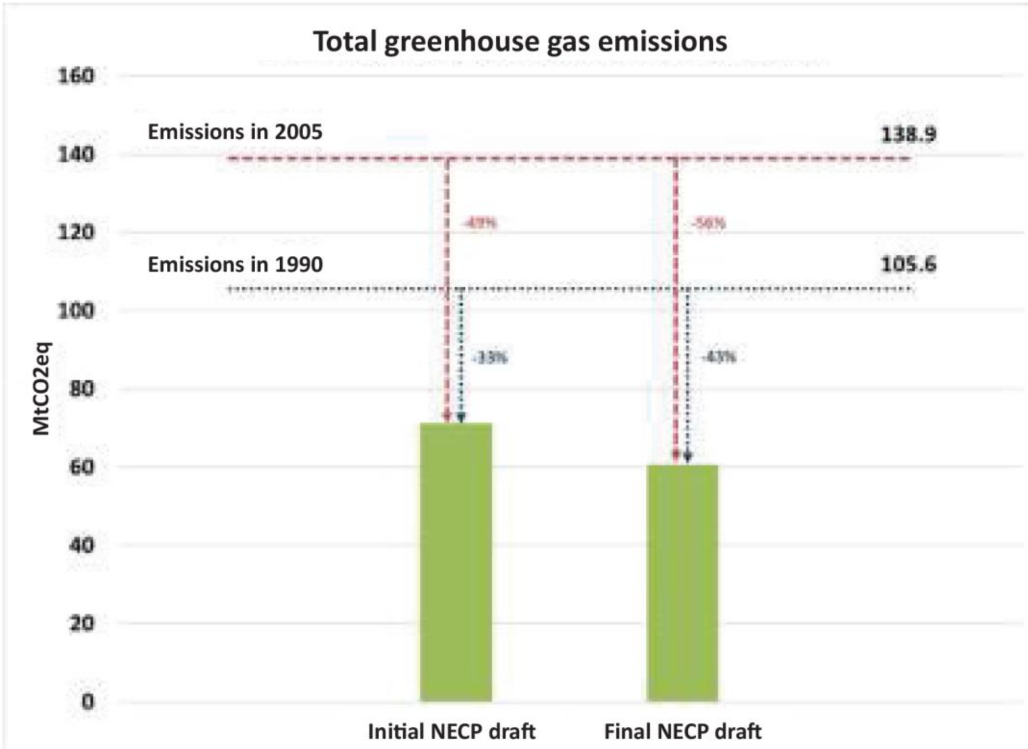


Chart 2: Comparing total GHG emissions for 2030, between the initial and final NECP drafts, with reference to emissions of 1990 and 2005.

The fuel mix is also diversified considerably between the two drafts (Chart **3**). The greatest difference consists in shutting down all lignite-fired plants instead of reducing them, as provided for in the initial draft. The consumption of lignite for power generation purposes will cease altogether in 2028, and the use of RES (wind farms and photovoltaics in particular) will increase considerably. There is also a significant increase in the share of natural gas in the energy mix, as new plants are to replace part of the output of lignite-fired plants and provide the system with the flexibility required by the increased share of uncontrollable RES plants.

There is also a sharp decrease is the share of diesel-fired plants, owing to their ever-increasing operating cost, which makes them non-competitive in relation to RES technologies, but primarily owing to speeding up the interconnection of almost all non-interconnected islands with the mainland system in the period under consideration, compared to the initial NECP draft, and the extended use of RES hybrid systems on the very few islands which are not to be interconnected.

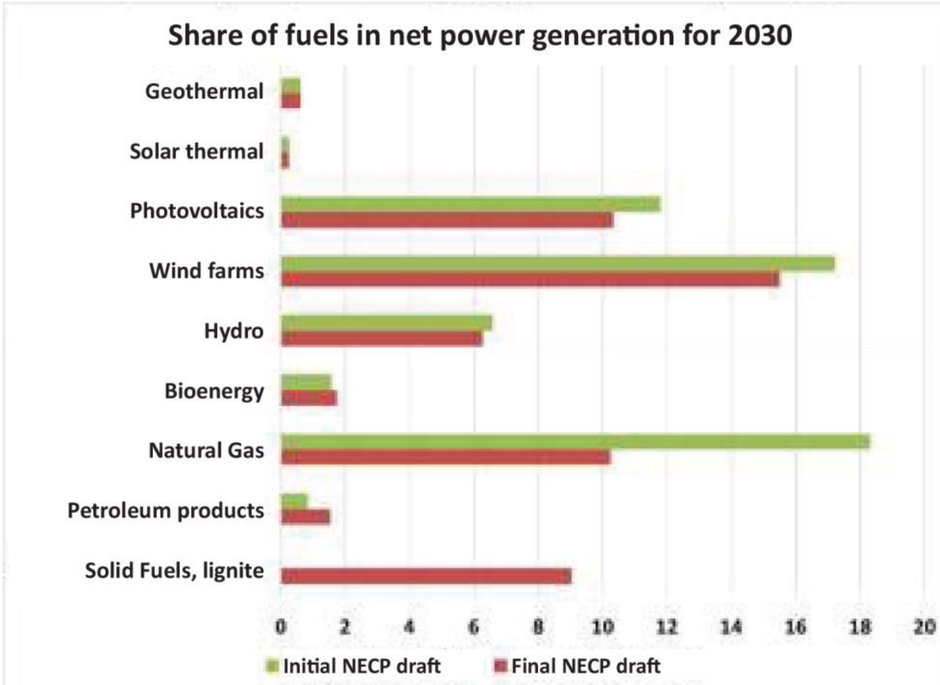


Chart 3: Comparing the share of fuels in net power generation for 2030, between the initial and final NECP drafts.

Table 4 and Chart 4 show the difference in the share of each sector or fuel, respectively, in final energy consumption, as calculated in the original draft and in this revised NECP draft, for 2030.

There is a considerable difference in final consumption in the domestic sector, as the decrease in final consumption is improved by 9.3% compared to the reduction in consumption foreseen in the initial NECP, as well as in the industrial sector, where the improvement in energy efficiency simulated in the final NECP is increased by 6% compared to that of the initial NECP. As regards other sectors, i.e. tertiary and transport, there are no substantial differences between the initial and final NECP drafts in terms of the percentage change in final consumption, whereas the estimated final consumption is expected to increase in 2030 compared to 2020 in absolute values.

Table 4: Change in final energy consumption per sector for the years 2020-2030.

	Initial NECP - Change in final energy consumption in 2020-2030	Final NECP - Change in final energy consumption in 2020-2030	Difference between the initial and final NECPs	Weighted difference between the initial and final NECPs
Industry	1.7%	-4.4%	6.0%	1.1%
Residential	-0.4%	-9.7%	9.3%	2.3%
Tertiary	0.6%	1.2%	-0.6%	-0.1%
Transport	1.3%	1.0 %	0.3 %	0.1 %
Total	1.2%	-2.5%	3.7%	3.7%

As regards fuels in final consumption, there is major change in petroleum products, natural gas and solid fuels, whose consumption is reduced by approximately 8% (700 ktoe), 13% (260 ktoe) and 34% (80 ktoe), respectively. There is a slight increase in electricity consumption, in the direct use of RES and in ambient heat, through heat pumps.

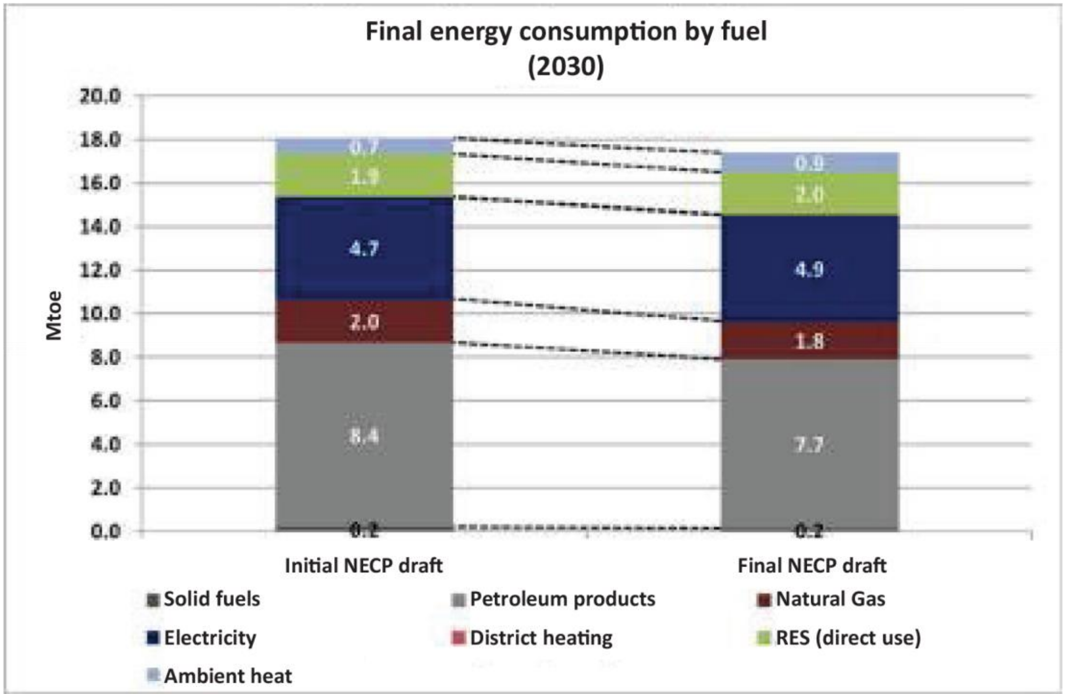


Chart 4: Final consumption per fuel for 2030, in accordance with the initial and final NECPs.

Following is a detailed description of the objectives and targets for each dimension of the NECP.

2.2 Climate change, emissions and removals of greenhouse gases

2.2.1 Objectives

The main objective of the NECP is to provide a roadmap for a substantial reduction in GHG emissions compared to specific reference years, thus demonstrating Greece's commitment to comply with the core EU targets for protecting the environment and addressing climate change for the benefit of people and of the society in general. In this context, the NECP includes general and specific objectives for Greece, which are very ambitious and much higher than the binding objectives laid down in the context of EU obligations.

More specifically, a core objective is set for a total 40% reduction in GHG emissions in Greece in 2030 compared to 1990, whereas the reduction objective compared to 2005, which is more comparable on the basis of the Greek economy levels and the related emissions at European level, exceeds 55%.

Moreover, with regard to non-ETS sectors, the reduction in GHG emissions exceeds 35.4% compared to the corresponding emission levels of 2005, thus the reduction rate being double that of the national commitment, which was least 16%.

Respectively, with regard to ETS sectors and uses, the estimated rate of reduction in GHG emissions under the NECP is over 70% compared to 2005, while it is much higher compared to the overall EU objective for reducing GHG emissions (almost 43% compared to the corresponding emission levels of 2005) (Table 5).

Table 5: Evolution of the reduction in national GHG emissions for 2030[7].

Evolution of the reduction in GHG emissions (% reduction)	2020	2022	2025	2027	2030
Reduction in emissions for ETS sectors and uses compared to 2005	52%	62%	65%	67%	74%
Reduction in emissions for non-ETS sectors compared to 2005	30%	31%	33%	34%	36%
Total reduction in GHG emissions compared to 2005	41%	47%	50%	52%	56%
Total reduction in GHG emissions compared to 1990	***23%***	***31%***	***34%***	***36%***	***43%***

[7] In the above forecasts for the evolution of GHG emissions, account is also taken of the ETS part of international air transport.

In addition to that, the NECP integrates and adopts the quantitative targets set in the context of the implementation of Directive 2016/2284/EC on the reduction of national emissions of certain air pollutants for the period 2020-2029 and for 2030 compared to 2005 (as shown in Table 6), which also requires the development, establishment and implementation of national air pollution control programmes, as well as the monitoring and reporting of the emission levels for relevant pollutants [sulphur dioxide (SO_2), nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC), ammonia (NH_3) and fine particulate matter ($PM_{2.5}$)] and other pollutants (CO, heavy metals, POPs, BC).

It should be noted that these emissions are not simulated or further analysed in the context of the NECP, as monitoring their evolution is an obligation of other national emission inventories and of the National Programme for the Control of Air Pollution, which is being developed in 2019, further analysing the impact of the NECP on the attainment of the objectives set for Greece under Directive 2016/2284/EC.

Table 6: Quantitative targets for reduction in national emissions of certain air pollutants for the period 2020-2029 and for 2030 compared to 2005.

Air pollutants	Percentage of emission reductions compared to 2005	
	Period 2020-2029	2030
Sulphur dioxide (SO_2)	74%	88%
Nitrogen oxides (NO_x)	31%	55%
Non-methane volatile organic compounds (NMVOCs)	54%	62%
Ammonia (NH_3)	7%	10%
Fine particulate matter ($PM_{2.5}$)	35%	50%

With regard to **climate change adaptation**, Greece has already developed and adopted by means of Law 4414/20 the National Strategy for Adaptation to Climate Change, which sets out the general objectives, guidelines and means of implementation of a modern, effective and developmental climate change adaptation strategy within the framework set by the United Nations Convention on Climate Change, EU directives and international experience.

The National Strategy for Adaptation to Climate Change is a strategic document aimed at providing guidelines and as such, does not analyse in depth the necessary sectoral policies, but includes indicative actions and adjustment measures for 15 sectoral policies: Agriculture and stock farming, forest ecosystems, biodiversity and ecosystems, aquaculture, fisheries, water resources, coastal zones, tourism, energy, infrastructure and transport, health, built environment, extractive industries, cultural heritage, insurance sector, without prioritising the corresponding measures and actions.

These topics will serve as the substance of the Regional Plans for Adaptation to Climate Change, which will specify the guidelines of the National Strategy for Adaptation to Climate Change by defining the immediate adaptation priorities at regional/local level. That is, the Regional Plans for Adaptation to Climate Change will precisely define, based on the climatic conditions and vulnerability of each region, the priority policy areas and geographic units for taking measures, and will also specify these measures, as well as the financial instruments for the implementation of the measures, the implementing bodies, the stakeholders, etc. The Greek regions are currently in the process of elaborating their own Regional Plans for Adaptation to Climate Change (with different degrees of maturity per Region).

This effort is being assisted by the European programme Life IP – Adapt In Gr 'Boosting the implementation of adaptation policy across Greece'[8]. This 8-year programme is coordinated by the Ministry of the Environment and Energy, with the participation of 19 bodies, including, inter alia, the Academy of Athens, the National Technical University of Athens, the Bank of Greece, as well as various Greek regions and municipalities. The aim of the programme is to support both the planning process and the implementation of the necessary adaptation measures at national, regional and local levels and to serve as leverage for mobilisation in order to facilitate effective adaptation to the impact of climate change in the following years.

Promoting circular economy and bioeconomy: Circular economy and bioeconomy will play a major role in the productive restructuring of Greece, with a clear regional dimension. The contribution of circular economy and bioeconomy towards attaining climate change mitigation objectives is considered to be particularly important, as it has been estimated that shifting to a circular pattern can lead to a significant reduction in GHG emissions through recycling and reuse of materials, more efficient use of resources and more eco-friendly product design, as well as through the introduction of new 'circular' business models, especially in industry, transport and the built environment. The 'circular' production model is considered to be easily adaptable to

[8] www.adaptivegreece.gr

the Greek economy due to the numerous opportunities and possibilities for resource utilisation, but also due to the changes that can cover a broader part of the economy, in the field of waste management in particular. The National Circular Economy Strategy, adopted by the Central Economic Policy Council on 17 April 2018[9], aims precisely at accelerating circular economy actions and unlocking growth potential, including a series of actions for the development of financial instruments, the planning and establishment of a regulatory framework and regulations, while at the same time removing bureaucratic obstacles, linking small and medium-sized entrepreneurship and social economy to technological innovation and improving governance and networking, as well as accelerating applications.

2.2.2 Challenges

The most important challenge for the majority of policy measures is to effectively address the complexity of different components (technical, administrative, managerial, institutional, social) that need to be addressed in order to properly implement the specific policy measures.

The lack of necessary infrastructure is a major challenge for the implementation of actions at a number of levels, e.g. the lack of necessary infrastructure for promoting the use of gas in transport or the effective management of waste streams.

With regard to the reduction in emissions of fluorinated gases, it is necessary to intensify and coordinate the existing control and sanctioning mechanisms. In the case of policy measures relating to the agricultural sector, the main challenge lies in the need to inform and integrate a large number of producers of agricultural products, as there are numerous small- and medium-capacity producers active in Greece.

Finally, the absence of control and certification procedures poses an obstacle to the proper implementation of policy measures for reducing fluorinated gas emissions and of other policy measures.

In some cases, there is also an absence of a regulatory and statutory framework that would facilitate the implementation of policy measures, and in that respect all necessary legislative and regulatory instruments and tools will be adopted in the context of implementing the NECP, to make possible the attainment of the objectives hereunder.

[9] http://www.opengov.gr/minenv/wp-content/uploads/2018/05/kykliki_oikonomia.pdf

2.3 Renewable energy sources

2.3.1 Objectives

The national objective to be attained in terms of the **RES share in gross final energy consumption** is **at least 35%.** Please note that the share of heat pumps for covering cooling needs in an a more energy-efficient manner is not yet taken into account in this share as RES contribution, owing to methodology-related reasons, as the necessary EU technical guidelines have not been issued yet.

There are also objectives for the RES share in **gross final electricity consumption to reach at least 60%, the RES share in covering heating and cooling needs to exceed 40% and the RES share in the transport sector to exceed 14%** in line with the relevant EU calculation methodology.

These quantitative objectives translate, depending on the evolution of final consumption, into specific quantitative values either in terms of installed capacity or in terms of a number of RES technologies/systems in final use (e.g. penetration of biofuels in transport, biomass boilers to cover heating and domestic hot water needs, heat pumps in buildings to cover heating and cooling needs, solar-thermal systems, etc.). Consequently, the quantitative correlation of these values is also directly linked to the attainment of the relevant energy efficiency improvement objectives.

Apparently, the key pillar for attaining the core objective for RES is the RES share in electricity consumption, and therefore this sub-sector is the main policy priority and poses the highest demand for the timely and efficient implementation of the measures planned. Attaining this objective requires a sharp increase in RES installed capacity for power generation, which is expected to more than double the current RES installed power for most of the relevant technologies. One can easily understand that this is a very ambitious, but also realistic, objective, taking into account the existing technical and economic potential and the investment interest already expressed. However, attaining that objective requires optimal response and functioning of the public bodies involved, of the regulator and of the operators, as well as of the RES market itself. Therefore, meeting this requirement in an optimal manner in the following period is a key challenge.

Another objective with regard to promoting RES and increasing their share in final consumption is the **electrification and coupling of final consumption sectors**.

On this axis, the gradual electrification of the transport sector is the major challenge in the following period. More specifically, a considerable penetration of electric vehicles is expected, making a substantial contribution to various dimensions of the NECP, whereas full electrification will be achieved in rail transport much earlier. The aim is to achieve this penetration in the most cost-effective way for the national economy, while at the same time appropriate infrastructure and the necessary regulatory framework must be developed in a timely manner as these are prerequisites for the electrification of the transport sector. A further aim is to combine consumption sectors to the greatest and most efficient extent possible, placing emphasis on maximising the use of RES. The electrification of different uses in final consumption is an essential component in achieving this aim. A typical example is heat pumps which, together with the future greater use of energy storage systems and autoproduction schemes, will make a decisive contribution in this direction. A similar example is the **possibility of feeding either hydrogen or methane produced from RES into the natural gas network**. In this direction, the sustainability and efficiency of such a scheme will be considered initially and, if deemed positive, appropriate measures and policies will be promoted.

Moreover, an objective has been set for promoting RES systems in buildings and dispersed generation systems, through autoproduction and net metering schemes. More specifically, a forecast has been made for having such RES power generation systems in operation with an installed capacity of 1 GW, capable of covering the average electricity consumption of at least 330 000 Greek households, by 2030.

As regards the evolution of RES shares in final consumption, Tables 7 and 8 show the forecast of the evolution of these shares at specific times.

Table 7: Evolution of RES shares per objective and per sector by 2030.

Evolution of RES shares	2020	2022	2025	2027	2030
RES share in gross final energy consumption [%]	19.7%	23.4%	27.1%	29.6%	**35%**
RES share in final consumption for heating and cooling [%]	30.6%	33.8%	36.8%	38.3%	**42.5%**
RES share in gross electricity consumption [%]	29.2%	38.6%	46.8%	52.9%	**61%**
RES share in final consumption for transport [%]	6.6%	7.3%	10.1%	11.7%	**19.0%**

Table 8: Progress in respect of the share of RES by sector by 2030.

Progress in respect of the share of RES energy in attaining the objective for 2030.	2022	2025	2027	2030
in gross final energy consumption	31.8%	53.6%	68.5%	100%
in final consumption for heating and cooling	27.0%	52.3%	64.5%	100%
in gross electricity consumption	29.6%	55.4%	74.6%	100%
in final consumption for transport	5.6%	28.3%	41.3%	100%

More specifically, while the evolution of RES shares in power generation and heating is relatively linear, the RES share in transport is expected to be more pronounced gradually after 2025, especially towards the end of the next decade and during the period 2028-2030, when it is expected, in economic terms, that electric vehicles will optimally penetrate the market, with RES representing the dominant share in the electricity mix compared to all other fuels, and that advanced biofuels will be used for the same reasons.

It should be stressed that the roadmap proposed in the NECP, despite clearly being non-linear as explained in the previous paragraph, is perfectly compatible with the timeline foreseen for the objective concerned in the context of the Energy Governance Regulation and incorporates the flexibility required at a national energy planning level in terms of market response and in terms of the optimal implementation and performance of the policies and measures planned.

This is considered to be the best possible development at a national economy level, as the scheduling of new RES projects for power generation and the coverage of thermal needs with RES systems will not lead to non-optimal financial investments and will protect the national energy system and available funding programmes from being trapped, at an early stage, in actions and measures that would be more efficient if distributed more smoothly over the period under consideration.

In the field of RES power generation, the dominant applications that will contribute to the attainment of the objectives in the following period are wind farms and photovoltaics, which are considered to be the most mature and competitive ones in accordance with market and cost-effectiveness rules in terms of their impact on aid issues. Tables 9 and 10 and Chart 5 show the evolution of the relevant values for RES technologies in power generation, indicating that the installed capacity of uncontrollable RES plants almost triples in the period 2017-2030. It should be noted that there is no specific timetable for offshore wind farms, but their share in the mix for attaining the power generation objective is taken for granted.

Table 9: Evolution of installed RES capacity in power generation.

Power generation, installed capacity [GW]	2020	2022	2025	2027	2030
Biomass & biogas	0.1	0.1	0.1	0.2	0.3
Hydro (incl. mixed pumping)	3.4	3.7	3.8	3.9	3.9
Wind farms	3.6	4.2	5.2	6.0	7.0
Photovoltaics	3.0	3.9	5.3	6.3	7.7
Solar thermal	0.0	0.0	0.1	0.1	0.1
Geothermal	0.0	0.0	0.0	0.0	0.1
Total	10.1	11.9	14.6	16.4	19.0

Table 10: Evolution of RES power generation.

Power generation [TWh]	2020	2022	2025	2027	2030
Biomass & biogas	0.4	0.5	0.8	1.0	1.6
Hydro	5.5	6.4	6.5	6.6	6.6
Wind farms	7.3	10.1	12.6	14.4	17.2
Photovoltaics	4.5	6.0	8.2	9.7	11.8
Solar thermal	0.0	0.0	0.3	0.3	0.3
Geothermal	0.0	0.0	0.0	0.3	0.6
Total	**17.7**	**23.0**	**28.4**	**32.2**	**38.1**

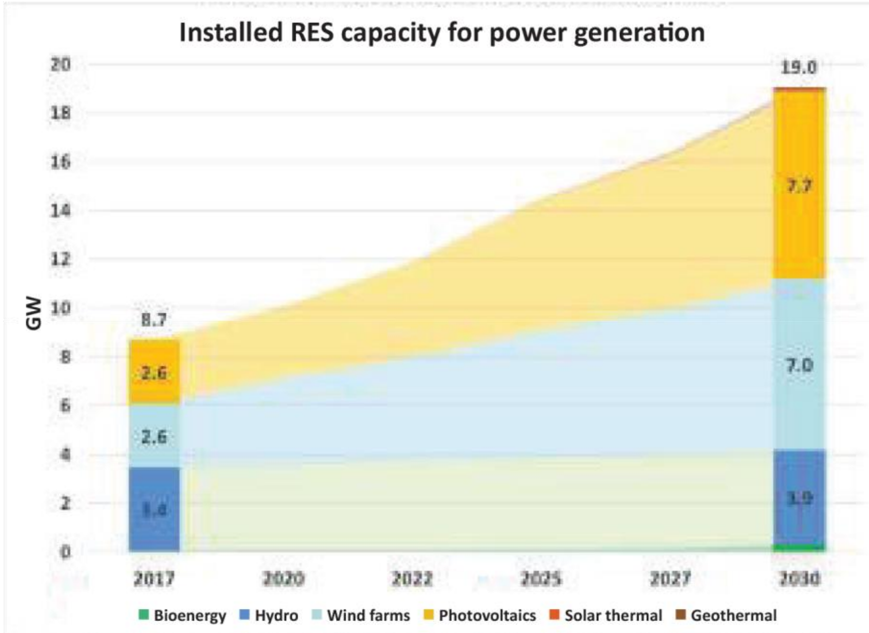


Chart 5: Evolution of installed RES capacity in the period 2017-2030.

An additional objective for the following period is to gradually evaluate, also through pilot facilities and where appropriate, new applications and/or technologies for RES power generation such as:

- wave energy utilisation,
- hydrogen production,
- combined desalination facilities,
- dispersed generation systems, such as small wind turbines.

Regarding the penetration and share of RES to meet thermal needs in final consumption, it is expected that there will be a significant increase in the role of heat pumps, especially in the tertiary sector, an increased share of thermal solar systems and geothermal energy, as well as a steady contribution of biomass (Table 11).

Table 11: RES contribution to meet thermal needs in final consumption.

RES for heating (ktoe)	2020	2022	2025	2027	2030
Bioenergy	1,035	1,060	1,087	1,086	1,142
Solar	296	303	312	326	411
Ambient heat, geothermal	431	590	715	792	906
Total	**1,761**	**1,952**	**2,115**	**2,204**	**2,460**

A contribution is also foreseen for the first time, albeit with a small share, from RES district heating networks, utilising primarily geothermal energy and biomass, and there is also an objective for gradually putting in place applications to feed biomethane or hydrogen into the natural gas network.

Lastly, electric vehicles are expected to make a substantial contribution towards the end of the following decade. The contribution of biofuels will remain dominant, with a particularly increasing share of advanced biofuels, during the last part of the period 2020-2030 in particular (Table 12).

Table 12:RES contribution in the transport sector.

Transport sector (ktoe)	2020	2022	2025	2027	2030
Biofuels	228	238	283	287	371
Electricity from RES	5	11	27	46	94
Total	233	249	310	333	465

2.3.2 Challenges

RES in power generation

In promoting RES in power generation, the complexity, delays and volatility of the existing institutional framework are the main challenges to the licensing of RES plants for power generation. The development of an integrated framework with regard to the siting of RES facilities, applicable across Greece and subject to clear-cut rules, criteria and constraints, is critical in ensuring higher RES penetration in power generation. Furthermore, the overall reform of the licensing framework is imperative in view of the new operating support scheme, the aim for the development and operation of a large number of new RES projects, as well as the possibility of direct participation in the electricity market in accordance with the requirements of the new directive.

The effective coordination and cooperation between the institutional bodies involved and the development of an efficient mechanism for monitoring all operating parameters are deemed to be necessary for the effective functioning of the revised licensing framework and for monitoring the effectiveness of the existing aid scheme.

In general, a substantial improvement in the implementation control and monitoring mechanism is required for numerous policy measures, and there are specific cases in which the necessary regulatory framework is yet to be completed.

The completion and full implementation of the new electricity market model is crucial for the effective functioning of the new plants which will be under obligation to participate in the electricity market. A critical parameter and challenge for the following period will be the fact that due account should be taken of all the specific characteristics, stochastic production from RES plants in particular, in order to adapt at a planning level, respectively, the operating parameters of the new energy markets that will allow for the optimal RES share in the new operating model of the electricity market.

As regards tender procedures, the development of special and common, as well as area-specific tender procedures, is already underway, and the evaluation of the scheme used for tender procedures in 2020 is expected to give clear directions in respect of their expansion and potential further homogenisation. At the same time, a significant challenge is the definition of a temporally stable framework for conducting these tender procedures with predefined auctioned capacity values, as well as the handling of non-optimal outcomes between the tenderers and/or selected plants. The eventual objective of these tender procedures is to achieve aid values that are comparable to those of other European countries and to eventually eliminate the need for operating aid for RES plants in operation. Also, in respect of the Special RES Account, the major challenge is to maintain the investment security that results from ensuring its long-term sustainability, as well as to improve its liquidity.

At a technical level, it is also critical for the following period to develop an appropriate institutional framework for storage units and have them participate in the electricity market. The participation of these units is considered to be crucial for attaining high shares of RES in the electricity market. In this context, plans have to be made immediately also for making possible the deployment of storage units within a RES plant, using simplified procedures.

A similar challenge for the following period is to develop and operate new categories of RES projects with technological innovation and/or local added value for power generation. The setup and functioning of small wind turbines incorporates such potential characteristics, and delaying the completion of the regulatory framework for this category of projects also delays the essential evaluation of such systems in terms of the economy and social acceptance. Offshore wind farms are expected to pose a new challenge for the regulatory framework, as the timely and integrated development of such a framework is a necessary prerequisite for launching these projects in the following decade.

As regards net metering, the challenge is to gradually expand the scheme and attain higher growth rates. At the same time, however, a mechanism will have to be developed gradually for monitoring its impact on regulated charges. In addition to that, the provision of technical support is crucial in specific policy measures, such as in the case of energy communities.

As regards the measures for expanding the transmission system and the distribution network in order to allow for the optimal and timely setup of new RES projects, there are various challenges which need to be addressed rather immediately, as there have been long delays caused already (also in issuing generation authorisations) in the implementation of RES plants and their integration in the energy networks. The management complexity and time lags due to external factors are the main challenges to the setup of such plants, and there is a need to address the congestion of the power grid in order to allow for setting up new RES capacity in areas with a high potential. Generally, it is necessary to put in place a more dynamic plan for integrating new RES plants in the power grids, which should incorporate the different regulatory and technical challenges and external parameters in a transparent and effective manner.

As regards the non-interconnected islands, the Management Code should take into account the new requirements for RES plants that affect even their operational/financial plan and require the completion of all necessary implementation tools.

A challenge — in technical and licensing-financial terms — that is expected to emerge gradually in the following period consists in the radical renewal of the equipment of end-of-lifecycle plants, although this is expected to culminate after 2030.

<u>RES for heating and cooling</u>

The incomplete regulatory framework and the absence of an implementation monitoring mechanism are the main problems relating to the promotion of RES in nearly zero-energy buildings, while the need for the stakeholders to obtain education/training and to adapt to the technical requirements is also critical.

In the case of geothermal energy, despite the existence of certain areas with a significant exploitable geothermal potential in Greece, the lack of information and the technical difficulties in implementing and developing the relevant district heating networks pose the major challenges to the use of geothermal energy in various areas with a significant exploitable geothermal potential in Greece. As regards exploiting these fields for power generation, there have been no developments at all either due to technical problems and defective licensing procedures or due to reactions on the part of local communities, thus depriving the electricity system of power generation plants that could function continuously and flexibly.

Similar problems are detected in respect of the energy utilisation of residual biomass, where growth rates are still very low. A technical and regulatory challenge expected in the following period is the transition to a new aid scheme for producing biomethane and feeding it into the natural gas network.

Emission problems (microparticles) due to open/free combustion spots and the absence of certification of the raw material used are the main obstacles to further promoting biomass for space heating, whereas corrective measures need to be adopted and regulatory tools need to be applied to mitigate the potential adverse environmental impact.

In the case of existing financing mechanisms, for the use of RES in final consumption, priority is given to simplifying the relevant procedures and selecting the most cost-effective applications. Moreover, it is important to develop performance indicators for the use of specific financing mechanisms in respect of technologies and types of users.

<u>RES in transport</u>

As regards policy measures for promoting RES in transport, it should stressed initially that the electrification of the transport sector, with high shares of RES in the electric mix, will contribute automatically to a higher RES share in energy consumption, plus the benefits relating to improved energy efficiency and reduced emissions and pollutants. The most important problem of electromobility is the high initial cost of electric vehicles, which has also undermined the sustainability of the required charging infrastructures. Completing the institutional framework for the operation of the electromobility market and developing the required infrastructures are an important parameter for, as well as a challenge to, the further promotion of the use of electric vehicles, along with reducing the purchasing cost of electric vehicles, which is expected to accelerate based on estimates from the global automotive industry in the period up to 2025.

As regards biofuels, similarly, the main objective should be to promote the use of Greek raw materials and to support domestic biodiesel producers. However, the current regulatory framework needs to be revised to render the further exploitation of biodiesel compatible with the policy on the promotion of advanced biofuels and the reduction of conventional biofuels in line with the requirements of the new Directive.

Please note that increasing the fleet of public transport vehicles of all types, as well as of the special-purpose public vehicles (municipal transport, municipal school buses, etc.) that will be powered by electricity or biofuels, aiming to reduce the use of private vehicles, will contribute both to an increase in the RES share and an improvement in energy efficiency in the transport sector. An additional challenge is to increase the use of electric micro-mobility vehicles, whether private or municipal available for rental, by utilising appropriate infrastructures and mechanisms for the use of such vehicles. Similar challenges are there with regard to vehicles used by businesses for supply and loading/unloading purposes.

Important challenges include providing consumers with information on the benefits of biofuels, establishing incentives for people and businesses, completing the regulatory framework, having sustainability criteria certified by voluntary schemes, and more effectively analysing and processing the statistical data collected by the information system, taking into account the reporting requirements of the new directive.

Challenges to the electricity system due to high RES penetration

Increasing the penetration of uncontrollable RES plants (wind farms and photovoltaics in particular) will increase the volatility and uncertainty of residual load (load less output of uncontrollable RES) and the flexibility needs of the system. The main categories of flexibility sources are dispatchable power plants, storage, interconnections and demand response. It is worth noting that the current level of RES penetration (with the gradual introduction of 5.5 GW of wind farms and photovoltaics in the interconnected system over the previous years) has been achieved without new storage facilities.

To achieve high levels of penetration of uncontrollable RES plants, as set out in the NECP, in an economically rational way (sufficiently low cuts in their output), there is generally a **need for energy storage**. For several decades, pumped storage has been the most widespread international method for large-scale storage of electricity. Today, international developments are rapid in terms of other forms of storage, for large or small installations, especially for batteries of different kinds. The coupling of markets via interconnectors in accordance with the provisions of the new electricity market model is important for achieving high levels of penetration. There is also interest in power-to-gas (e.g. hydrogen) storage applications, in the context of which the interconnection of electricity and gas networks is also investigated. Moreover, given the international interconnections of the Greek mainland system, the investigation of the needs for storage and coverage thereof at a regional level may also prove efficient.

It is also worth noting that, apart from storage requirements, the transformation of the electricity system to attain a 50% RES penetration poses other technical challenges too. For example, it is very likely that, even before these levels of energy penetration per year are attained, there may be even higher percentages of 'instantaneous' penetration of uncontrollable power plants, e.g. wind farms and photovoltaics, whereupon electricity network operators should be prepared for the management of these plants.

2.4 Improvement in energy efficiency

2.4.1 Objectives

As regards the energy efficiency dimension, the objective is to improve energy efficiency in final energy consumption **by at least 38%** in relation to the foreseen evolution of final energy consumption by 2030, as estimated in 2007 in the context of the EU energy policies, thus resulting in final energy consumption levels of not more than 16.5 Mtoe in 2030. There is also satisfactory performance in terms of the relevant evaluation indicators regarding the rate of reduction both with regard to final energy consumption for 2017 (16.8 Mtoe) and the energy savings target for 2020 (18.4 Mtoe), taking into account the increase in final energy consumption in order to reverse the impact of the economic recession of the previous years. This rate of reduction is even higher if adjusted to primary energy consumption, in which case it stands at **more than 43%**. This demonstrates that the overall objective is to achieve an improvement in energy efficiency across the energy system, attaining a particularly high level of improvement in terms of how energy is made available for consumption, always in the most cost-effective way. An additional objective is set in respect of the cumulative amount of energy savings to be attained over the period 2021-2030 in accordance with Article 7 of Directive 2012/27/EU on energy savings obligations. According to the available final energy consumption figures, cumulative energy savings of at least 7.3 Mtoe should be achieved over the period 2021-2030. However, the objective will be re-calculated on the basis of the final energy consumption figures for the years 2016-2018.

In addition to that, an objective is set for the annual energy renovation of a total floor area of the thermal zone of central public administration buildings equal to 5 400 square meters, representing 3% of the total floor area, as shown in Table 13.

Table 13: Central public administration buildings.

No	Organisation's name	Building floor area
1	Hellenic Parliament	24,000
2	Presidency of the Republic	1,538
3	Presidency of the Republic	856
4	Ministry of Shipping and Island Policy	1,007
5	Ministry of Shipping and Island Policy	2,034
6	Ministry of Shipping and Island Policy	535

No	Organisation's name	Building floor area
7	Ministry of Shipping and Island Policy	5,951
8	Ministry of Shipping and Island Policy	4,855
9	Ministry of Digital Policy	655
10	Ministry of Foreign Affairs	11,237
11	Ministry of Foreign Affairs	7,031
12	Ministry of Foreign Affairs	8,268
13	Ministry of Foreign Affairs	2,848
14	Ministry of Foreign Affairs	3,008
15	Ministry of Foreign Affairs	3,776
16	Ministry of Foreign Affairs	3,014
17	Ministry of Foreign Affairs	7,415
18	Ministry of Transport and Infrastructure	12,419
19	Ministry of Transport and Infrastructure	620
20	Ministry of Health	12,600
21	Ministry of Development and Investment	16,800
22	Ministry of the Interior, Macedonia and Thrace	11,236
23	Ministry of Justice	973
24	Ministry of National Defence	9,500
25	Ministry of National Defence	10,208
26	Ministry of National Defence	2,058
27	Ministry of National Defence	11,580
28	Ministry of National Defence	1,900
	TOTAL	***177,922***

The need to renovate the existing building stock is indisputable, as this will result in significant energy savings and in cost savings for citizens, and will also improve the comfort, safety and health conditions in the use of these buildings.

To that end, it is necessary to **establish a central quantitative objective for the renovation and replacement of residential buildings** with new nearly zero-energy buildings, which could in aggregate amount to 12-15% of all residential buildings by 2030. **The annual objective is to have an average of 60 000 buildings or building units upgraded in terms of energy and/or replaced with new more energy-efficient ones**. This particular objective will contribute significantly to the major upgrading of the ageing building stock, while at the same time giving a substantial boost to the construction industry through high added value technologies and essentially ensuring increased financial and operating benefits for households in Greece, also enabling them to cover their energy needs.

Moreover, in respect of this dimension as well as other dimensions of the NECP, the aim is also **to increase the use of natural gas in final consumption**. More specifically, natural gas is expected to be the intermediate fuel for switching to a low GHG emissions model in all final consumption sectors, and may also lead to both improved energy efficiency and lower energy costs compared to other conventional technologies. A key aim is to achieve a higher gas share in all final consumption sectors and, essentially, to ensure that its increased use replaces part of the current consumption of petroleum products in these sectors. The development of the necessary transmission and distribution infrastructure to allow access to natural gas for higher percentages of end users in the building sector and the further increase in its use in industry and transport are priorities for the forthcoming period. The quantitative objective for this priority is to increase the direct use of natural gas in the final consumption sectors by at least 50% compared to 2017.

Finally, the implementation of all the necessary investments in final energy consumption sectors with a view to improving energy efficiency requires that more effective financing mechanisms be planned in order to increase and maximise the current levels of private capital leverage. The active involvement of the financial sector and the promotion of innovative financing mechanisms and market mechanisms, including energy performance contracts, are critical parameters for attaining this objective.

2.4.2 Challenges

In the case of policy measures relating to infrastructure development, technical complexity and the definition of both the technical specifications and the implementation mechanism are the main problems, causing significant delays.

It should also be stressed that there is a need to develop effective mechanisms for measuring, controlling and monitoring the policy measures, which must be accompanied by the development of the necessary tools and formats. Training, development of certification systems and smooth market adaptation to the technical requirements are considered to be essential prerequisites for the effective planning and implementation of policy measures.

Several policy measures require the adaptation of the regulatory framework, while in the case of public procurement, including interventions in public buildings and using new innovative design standards and digital models, complexity is an indisputable challenge that needs to be addressed.

With regard to existing funding mechanisms, the key challenges include the selection of cost-effective applications, the simplification of existing procedures, the absence of incentives to implement efficient measures and technologies and the difficulty in financing projects through energy performance contracts.

In addition to that, there must be a transition to the next implementation phase for specific policy measures. For example, in the case of energy efficiency obligation schemes, the main challenges are the transition from behavioural to technical measures and the further expansion of the existing scheme through the option of exchanging certified energy-saving units.

Moreover, with regard to the energy upgrading of public and private buildings, ensuring economic efficiency and technical and operational feasibility for different uses and categories of buildings requires relevant changes to the legislative framework. Finally, the planning of policy measures should in any case be holistic in order to avoid possible incompatibilities between the policy measures already in place and the new measures being planned.

2.5 Energy security

2.5.1 Objectives

With regard to the dimensions of energy security and of the internal energy market, it should be stressed that the qualitative and quantitative objectives that concern them are often complementary and interconnected, and both the policies and measures planned take into account both dimensions in most of the cases. The most typical example is energy infrastructures, both international and internal interconnections, that contribute to attaining objectives of both dimensions.

With regard to the dimension of security of energy supply, the qualitative objectives developed in the context of the NECP are broken down into the following main categories:

Increasing the diversification of energy sources and suppliers from third countries

Strengthening the diversification of energy sources and of fuel supplying countries, to prevent dependence on just one fuel or just one country, is a key objective for the following period. This diversification also increases competitiveness between fuels and suppliers from third countries for the benefit of Greek consumers and makes a substantial contribution towards strengthening the security of supply, also protecting the supply of energy to Greece in the event of an energy crisis at a regional level.

Optimal utilisation and use of domestic energy sources: The recognition of potential and the most cost-effective utilisation of domestic energy sources are a key objective and aim for the development of the national energy system. More specifically, the utilisation and use of RES potential, both for power generation and for immediate supply and use in final consumption, make a substantial contribution towards energy security. However, on this axis it is also necessary to highlight the crucial role of improving energy efficiency and achieving energy savings as a 'type' of domestic energy source in energy security, in which we have a corresponding high potential. The utilisation and use of this 'source' constitutes essentially the horizontal priority and first action for implementing policies and measures on all NECP themes. On a complementary basis, albeit with a different approach and planning policy, the exploration for extraction and the exploitation of domestic hydrocarbon fields are still energy policy axes for the following period and are included in the broader framework of utilising domestic energy sources.

Highlighting Greece's profile as a regional energy hub: Strengthening and utilising the geopolitical role of Greece is a national objective. Therefore, there is an urgent need to complete the existing interconnections and to design new international interconnections with pipelines from third countries. In addition, these actions will also contribute to the diversification of energy sources and supply routes from third countries.

More specifically, with regard to the electricity market in the next decade, the following interconnection projects are being implemented/promoted:

- Second Greece-Bulgaria interconnection
- Support through the implementation of the interconnection of Crete in the context of the Greece-Cyprus-Israel interconnection project
- Upgrading the of Greece-Republic of Northern Macedonia interconnection

Greece is also promoting several cross-border / international gas transport projects, enhancing the diversification of energy sources for Greece and other European countries and, in conjunction with the promotion of natural gas storage systems, strengthens their energy efficiency in case of natural gas shortage.

Reducing the energy dependency rate: Reducing the energy dependency rate is another important objective for the transformation of the national energy system. Moreover, high energy dependency is an issue that concerns the whole of the European Union, with the highest rates appearing in small, developed economies such as that of Greece. Greece's high energy dependency is due to the particularly high use of petroleum products and, to a lesser degree, natural gas, which together account for more than 65% of gross domestic energy consumption and are almost entirely imported mainly from countries outside the European Economic Area. Within the context of the NECP, the objective is to initially prevent an increase in energy dependency rates and ultimately to reduce these rates gradually, ensuring the proper functioning and security of supply of the national energy system. In quantitative terms, this objective consists in reducing energy dependency from the high average rates of approximately 78% recorded in recent years. The initial aim is to prevent an increase in these rates and stabilise them at a level of 75%, and then to reduce them at around 70% by 2030. Essentially, a visible reduction in the rate of energy dependency is expected despite the lignite phase-out in domestic power generation and the recovery of the Greek economy, mainly due to the improvement in energy efficiency and the significant increase in the RES share. Moreover, the objective for the period after 2030 is to further and more rapidly reduce the rate of energy dependency primarily through an increase in the utilisation and use of the RES potential, an improvement in energy efficiency and an overall change to energy consumption patterns by increasing the utilisation of new technologies and applications.

Interconnection of autonomous electrical island systems: In Greece, there are currently 29 autonomous island electrical systems (32 until the recent implementation of Cyclades Interconnection - Phase A in 2018), which require increased operating funds and cannot ensure — fully and under all circumstances — smooth and optimal power supply to consumers.

The objective set is that, by the end of the next decade, most of these autonomous systems should be interconnected with the interconnected system, thereby achieving savings for the national economy, reducing energy dependency, providing the same high quality electricity and services to people, complying with the requirements of environmental legislation, and further utilising the potential of domestic renewable energy sources available in these island systems.

Even if the interconnection of some small and remote electrical systems is not technically efficient and cost-effective, innovative energy applications will be implemented in these systems in the context of developing hybrid systems and ‘smart’ island policies. In quantitative terms, under this objective all autonomous electrical systems will have been interconnected or upgraded by 2029.

Ensuring adequate system capacity: The objective is for Greece to ensure adequate system capacity in order to attain a minimum level of reliability for covering the demand for electricity in the system, in conjunction with Greece’s objective for shutting down all lignite-fired plants by 2028. To attain this objective, it will be necessary to adopt mechanisms for strengthening the system with power generating capacity or promoting demand response if the functioning and prices of the internal electricity market fail to give appropriate ‘signals’ for developing new power generating capacity or developing demand response systems and operators. More specifically, the participation of demand in the internal electricity market will, apart from increasing adequate system capacity, will lead to a reduction in electricity costs and a decrease in energy dependency.

Island interconnections and RES penetration in autonomous island systems

New island interconnections are being promoted in Greece, which are currently functioning as autonomous electrical systems based mainly on diesel-fired power plants. After the recent completion of Cyclades Interconnection - Phase A, the electrical systems of Paros (including the islands of Naxos, Antiparos, Ios, Sikinos, Folegandros, etc.), Syros and Mykonos were also interconnected. In the period 2020-2030, **almost all the Aegean islands will also be interconnected, starting with the interconnection of Crete.**

Island interconnections will allow for supplying these islands with a cheaper fuel mix, thus avoiding the PUO charges made for power generation with imported diesel, which is more expensive. Upon completion of the interconnection programme, this is expected to ensure estimated annual savings, owing to the PUO charges, of EUR 0.5 billion. Reducing the use of diesel on the islands to be interconnected by 2030 will also contribute to a 3% reduction in energy dependency, as this will stop the consumption of more than 900 thousand tons of diesel annually for power generation on the islands at the end of the decade. Similarly, there are significant benefits in terms of reducing GHG emissions. Moreover, after the interconnection, it will be possible to utilise the islands' RES potential in a more cost-efficient way, to provide the same quality of electricity and services to Greek citizens and to comply with the requirements of environmental legislation.

The aim is to have most of these autonomous systems interconnected with the interconnected system by the end of the next decade.

For islands that are not expected to be interconnected, a significant reduction in the use of diesel for power generation is also being promoted, **with the setup of state-of-the-art RES plants combined with storage technologies** . In this direction, the setup of **hybrid RES plants** is promoted either through private projects or through pilot projects such as the CRES project for the **conversion of Agios Efstratios into a 'green island', whereas a hybrid RES plant has already been commissioned on the island of Ikaria and another one on the island of Tilos.** Also, Greece participates actively in the new EU initiative **'Clean Energy for EU Islands'**, along with 13 other Member States.

2.5.2 Challenges

The integration of uncontrollable RES plants (wind farms and photovoltaics in particular) increases the need for system flexibility. High penetration levels require energy storage for sufficient take-up of the energy generated by RES plants, also depending on the system interconnection level and the conditions of neighbouring systems. Moreover, storage also contributes to adequate system capacity. In order for RES to become the main source of energy in the mainland electricity system (and in island systems that will remain autonomous), major system transformation is needed to maintain and strengthen the security of supply.

Another key challenge for the following period, apart from promoting lignite phase-out in the energy system, is reducing the energy dependency of Greece, including the gradual reduction of, and permanent end to, domestic lignite-fuelled power generation, thus necessitating the utilisation of the increased domestic RES potential and the improvement of energy efficiency in final consumption.

The development of domestic hydrocarbon extraction, with maximum direct public economic benefits at national and local levels and in a way that is both safe and compatible with the natural and man-made environment, is another major challenge in the following period. Also, promoting a system of redistribution of hydrocarbon-derived resources to support local economies affected by the lignite phase-out in power generation is expected to mitigate the direct and indirect impact at a local level, making the operation of this feedback loop a priority in the public interest.

With regard to policy measures for developing infrastructure for international and domestic interconnections, the major challenges are management complexity, time lags due to external factors and availability of resources, which require dynamic planning with the option of incorporating the different regulatory and technical challenges and external parameters.

In this context, we should highlight the FSRU project in Alexandroupolis, which is a top priority project whose licensing process has really progressed already. This project has attracted the interest of investors wishing to obtain a holding in the share capital of the company that is implementing it. Moreover, the final market test phase, relating to capacity commitment, is expected to be completed by early 2020. The project has already attracted the interest of suppliers expecting to enter the Southeast and Central European market, thus contributing to the elimination of monopolistic regimes. It has also attracted the interest of final consumers in this geographical area wishing to have direct access to more competitive gas prices in order to reduce their production costs. This has been designated as a project of common interest (PCI), and its effect in conjunction with the IGB pipeline, whose construction has started, at a regional level will be decisive in making Greece a real hub in the gas market. The aim is for the Hellenic Energy Exchange to put in operation a trading platform in the context of the gas market in 2020, thus expanding Greece's options of becoming an energy hub.

Similarly, the construction of an underground gas depot in the offshore field of South Kavala, which is being depleted, is an energy infrastructure that can offer a variety of mechanisms for supporting measures to mitigate and/or prevent supply security crises in Greece and contribute both towards ensuring balance in the transmission system and increasing competition, which will have an apparent impact in terms of reducing energy costs. Moreover, this infrastructure, in conjunction with the FSRU project in Alexandroupolis and the TAP and IGB gas pipelines, is very important for the Greek and Balkan markets. The underground depot can be used for the long-term storage of sufficient quantities of natural gas either for commercial purposes or for use in case of an emergency that could have a significant impact on Greece's supply. The current gas market, the existing infrastructures and the fact that power generation depends greatly on imported natural gas stress the need to construct the underground depot, which will serve as an additional entry point in the transmission system, thus increasing the level of energy security and contributing towards satisfying the infrastructure standard (N-1) and the supply standard provided for in Regulation (EU) 2017/1938. The procedures for conducting an international tender are at the final stage.

Finally, with respect to demand response measures, changes need to be made to their implementation process, the completion of the electricity market reform, the development of the necessary monitoring infrastructure and systems (e.g. smart meters) and the selection of appropriate economic incentives to ensure the involvement of final consumers to whom they are addressed.

2.6 Internal energy market

2.6.1 Objectives

The qualitative objectives developed at an internal energy market level are broken down into the following main categories:

Market integration and competitive energy markets

A key reform in restructuring the internal market in electricity consists in reducing domestic lignite-fuelled power generation through the scheduled shutdown of all lignite-fired plants by 2028.

Safe and efficient system operation in accordance with the new power generation mix, where RES plants will play a dominant role, will be possible by reorganising the markets in electricity and natural gas and coupling them with those of other Member States. In this direction, Greece is promoting measures to harmonise the domestic markets in electricity and natural gas with the EU directives and regulations on the markets in electricity and natural gas (target model).

The coupling of day-ahead markets between Greece and Italy and between Greece and Bulgaria is expected to be launched in the fourth quarter of 2020. The coupling of intraday markets through continuous trading in the region of the Italian border (LIP14) is expected to be launched in the fourth quarter of 2020 (3rdWave). The launch of the coupling of intraday markets through continuous trading will coincide with the launch of regional intraday auctions on the Greece-Italy interconnection and potentially on the Greece-Bulgaria interconnection, whereas the pan-European intraday auctions (IDAs) are expected to be launched in the fourth quarter of 2021.

The coupling of the markets will, due to improved energy flows via the interconnections, will help increase the liquidity of the interconnected markets and enable the participation of RES in the cross-border trade in electricity.

By participating in the new markets, RES will have the incentive and ability to balance their position closer to real time, thus reducing the needs and the associated costs for reserves and increasing system security.

As regards regional coordination for safe system functioning, in November 2019 the Greece-Italy and Greece-Bulgaria-Romania system operators agreed to establish a Thessaloniki-based Regional Security Coordinator, responsible primarily for providing the operators with decision-making and network security support.

Greece's objective is also to strengthen the role of electricity market consumers by increasing demand-side participation in the electricity market and to promote the deployment of storage systems that will ensure lower electricity and gas prices and will strengthen RES penetration in the system and adequate system capacity.

Please note that Greece, through long-term capacity compensation schemes and by applying interruptibility schemes, aims to encourage demand-side participation in the electricity market in order to reduce energy costs and increase adequate system capacity. At the same time, Greece, by developing a pricing framework, aims to promote the setup of electricity storage systems both in the autonomous systems on non-interconnected islands and in the interconnected system of Greece. The setup of storage systems on non-interconnected islands aims to increase RES penetration in these systems (in addition to the existing 20%) and to strengthen the system's generation capacity in order to meet the demand, whereas the setup of storage systems in the interconnected system, in addition to reducing energy costs and increasing adequate capacity, aims to strengthen RES penetration and provide flexibility and ancillary services in the System.

More specifically, Greece is promoting the setup of storage systems with RES plants on smaller islands that will retain their autonomous operation by applying pilot modes of operation and using management to achieve RES penetration levels of over 60%, whereas the objective for one of these islands (Agios Efstratios) is to achieve a RES penetration level of more than 85%.

In line with the electricity market, Greece also aims to integrate the natural gas market and strengthen the participation of the storage and demand response systems of the gas market, while promoting, through the construction of new cross-border natural gas transport projects, the reorganisation of the gas market, the strengthening of the gas transmission network with new storage tanks and the implementation of market participation policies for large customers in the gas market through demand restraint orders, thus reducing energy costs and increasing adequate capacity and energy in Greece.

Electricity interconnectivity

Increasing cross-border transmission capacity is necessary for the following reasons:

- ✓ it contributes significantly to the security of supply;
- ✓ it is a key factor in the integration of national electricity markets (according to the Barcelona criterion, the minimum electricity import capacity should be at least equal to 10% of the installed generation capacity in each country);
- ✓ it will allow for the desired high RES penetration in Europe.

The average total electricity import capacity was 1 565 MW for 2017, representing an average of 9.3% for 2017, while it is estimated that the 10% target will be reached by 2020. The Greek government is promoting projects to increase the capacity of electricity interconnections to and from the North, both by constructing new transmission lines and strengthening existing ones. These projects are also accompanied by projects for enhancing transmission systems in the broader region of the Balkans, the ultimate objective being to increase the interconnection capacity of the area and meet the target for 2030 (**15% interconnectivity**) to be attained in accordance with the relevant section of the NECP.

Energy transmission infrastructure

Greece aims to become an energy hub for both the market in electricity and natural gas. Therefore, Greece is promoting projects, which will be implemented in the following decade, to strengthen its electricity interconnection with neighbouring countries and, at the same time, to connect most of the non-interconnected islands with the mainland system, thus contributing significantly to the integration of the electricity market.

Moreover, the interconnection of most of the non-interconnected islands with the system aims at:

- ✓ increasing reliability in covering the demand for electricity on the interconnected islands at an interconnected system level (Note: Even for large non-interconnected systems, the internationally recommended reliability indicators may be twice worse). It should be noted that reliability is related firstly to adequacy (ability to supply the loads taking into account predictable and unpredictable interruptions), and secondly to system security (ability to withstand disruptions such as short circuits or loss of components);
- ✓ substituting diesel with other energy sources (in line with the development of the energy mix in the mainland system), resulting in lower generation costs and lower energy

dependency (to the extent that the mainland system mix consists mainly of domestic sources);

- ✓ utilising RES potential on the islands in a more cost-effective way.

With regard to the gas market, future projects that will contribute to enhancing the security of supply and the technical adequacy of the national gas system are described in detail in Chapter 3 hereof.

In addition to the strategic projects for the transmission of electricity and natural gas, the Hellenic Electricity Distribution Network Operator (DEDDIE) is promoting projects to streamline the remote control of networks all over Greece, the implementation of new customer service systems all over Greece, the optimised management of the electricity systems on the non-interconnected islands etc., while gas network operators and distributors aim to develop and expand the natural gas distribution networks in the Greek territory in order to provide cheap energy to all people.

Digitisation of the energy system: The digitisation of the energy system is a prerequisite for the development of properly functioning and competitive domestic energy markets and for the optimal implementation and use of all technological applications and market mechanisms that can be developed in the context of the energy markets. Emphasis will be placed, through the operators' development programmes, on planning and implementing the relevant infrastructure projects, information systems, control centres and metering devices that will allow for the complete transition from the current energy system to a fully digitised one, also ensuring secure handling of consumer data. The above procedures will be compatible with all regulatory and statutory provisions in the context of the energy markets. At the same time, the aim is to achieve optimal cooperation between operators in respect of data management, addressing technical issues and developing necessary ancillary services. If producers apply the relevant EU regulation without delay and adopt a single certification and control system, this will also make a significant contribution towards attaining this aim.

Addressing energy poverty: Energy poverty has worsened gradually, primarily over the last few years, and therefore addressing it is imperative. The worsening of this phenomenon is mainly due to the economic recession and its impact on people. Indicatively, about 23% of the total population are reportedly unable to heat their homes, while this percentage was 41% in 2017 among the economically vulnerable population. Targeted policy measures will be launched with a view to eliminating the energy poverty of energy-vulnerable households, meeting the anticipated comfort conditions and avoiding the resulting health problems. An environmental objective for all people, both vulnerable and not, is to reduce air pollution, especially in urban centres. The quantitative objective is to reduce by at least 50% the relevant energy poverty footprint by 2025, as well as to reduce it by 75% compared to 2016 and to bring it to levels well below the EU average by 2030.

Net metering and active consumer schemes: The contribution of net metering and energy community schemes is twofold, as they will contribute both to the implementation of RES and energy saving investments and to the more active participation of the local community and ultimately to the strengthening of the role of people in energy activities. Achieving a minimum number of projects through these schemes is deemed to be crucial for shaping and assessing the required implementation framework. In this context, the aim is also to develop innovative net metering schemes, both in energy generation and consumption, thus supporting decentralised energy generation and management. The quantitative objective is to set up and operate new autoproduction and net metering systems, primarily with a view to covering own needs of over 600 MW by 2030 (to reach in total more than 1 GW of installed capacity), and to engage aggregators through the possibility of participation of energy communities and of people in energy markets.

2.6.2 Challenges

Completing the regulatory framework and implementing the necessary technological infrastructures are prerequisites for launching new electricity markets and coupling them with the other European ones through interconnections.

At the same time, measures for proper market functioning, i.e. the existence of liquidity for spot markets, the provision of adequate hedging, the restriction of manipulation and the capability of active consumer participation, are necessary for the successful functioning of the internal market.

Developing a mechanism for market monitoring indicators for assessing the level of market concentration through cooperation between the competent bodies is important, while at the same time mechanisms also need to be developed to analyse bidding behaviour and thus detect anti-competitive practices.

The digital transformation of the DEDDIE, with a view to being able to respond to the challenge of increased RES penetration, management of decentralised systems for energy generation and storage, and electricity transactions, is pivotal. Congestion management will now be handled through close cooperation between DEDDIE and the Independent Power Transmission Operator (ADMIE), by implementing appropriate infrastructures and mechanisms to ensure mutual network visibility. Network development will take account of the change to the focus of decentralised generation.

The development of new financial instruments that are compatible with the new market environment will contribute to the implementation of the required investments.

We should also refer at this point to the proposed change to the regulatory framework for incentives for the implementation of such projects, e.g. payment of an additional rate of return on capital costs and/or setting of minimum performance indicators for the attainment of actions and targets.

Under the Action Plan for Combating Energy Poverty, it is necessary to assess the implementation of the existing policy measures in order to decide on whether they should be continued, to develop and implement a methodology for selecting the most cost-effective measures and to avoid using the benefits planned for purposes other than combating energy poverty. Moreover, a challenge is to develop effective mechanisms to control and monitor the policy measures in place, including the procedure for verifying beneficiaries.

Finally, it is necessary to provide funding mechanisms for the energy upgrading of the residential buildings of energy-vulnerable households and other social groups with specific electricity consumption patterns in the context of autoproduction and net metering schemes.

2.7 Research, innovation and competitiveness

2.7.1 Objectives

The Greek Research and Innovation System is one of the strengths of the Greek economy, which can further contribute towards solving many problems and ensuring the overall development of the Greek economy.

Promoting research and innovation will continue to be a priority in the period 2020-2030, by strengthening important technologies which will contribute to the attainment of all energy objectives. To that end, gross domestic expenditure on research and technological development is expected to double in the period 2017-2030, reaching 0.13% of the GDP in 2030 in the energy-environment sector, compared to 0.06% in 2017.

In terms of competitiveness, the indicators preferred for the attainment of the objectives are:

Improving energy intensity and greenhouse gas emissions intensity: A key objective to be attained through this indicator is to achieve the gradual decoupling of economic growth from energy consumption and GHG emissions. Improving energy intensity and emissions intensity indicators through the adoption of targeted measures will ensure that this will be the result of the energy efficiency improvement measures to be implemented and will contribute to both reducing energy costs and enhancing the competitiveness of the various economic sectors. This ensures that the positive development of the economic environment and of the various structural factors will not hinder the progress of the overall energy policy objectives and the transition to a low-carbon economy. The penetration of RES in all areas of final energy consumption, the rational management of energy, as well as the use of more energy-efficient devices and processes are the key tools to attain this objective.

Reducing energy costs: Reducing energy costs is a key policy priority for making energy products more accessible to all consumers. Measures and policies in the context of this objective will take into account the purchasing power of consumers and their special groups, as well as any specificities related to local characteristics, such as those of remote areas. Maintaining an average cost of energy products below the European consumer average is also the relevant quantitative objective of this energy planning priority. The aim of energy planning is also to adopt measures and policies for specific economic sectors and activities with a high energy footprint and a focus on exports, in order to significantly improve their competitiveness.

Increasing the domestic added value of the energy sector: Recognising and ultimately promoting innovative applications and services in the energy sector with high domestic added value is a priority target for the following period, as it contributes positively to the gross domestic product and enhances the sustainability of the energy sector. In addition, this objective also ensures an increase in the number of direct and indirect jobs due to activities in the energy sector. The use of specialised scientific and technical human resources is a core priority of energy planning, and also aims to create and maintain over 60 000 jobs by implementing RES and energy-saving measures and policies.

Development plans for the areas that will be affected most by the transition to a low-carbon economy: The challenges faced by lignite-dependent areas for the transition to a low-carbon economy can be tackled with tailored solutions to support structural transformation and accelerate the process of economic diversification and technological transition. The aim is to elaborate a sustainable development strategy plan, focusing on sectors with dynamic prospects in terms of output, employment and income indicators. In this case, local satellite companies of every scale will be mobilised so that every region or local society can reap the benefits of switching to clean energy, new jobs are created and investment in new technologies is promoted. Also, promoting a system for the reallocation of resources from hydrocarbons in order to support local economies that are affected by lignite phase-out in power generation could contribute to the competitiveness of these energy regions in their transition to the new era.

2.7.2 Challenges

The more specific technological challenges in research, innovation and competitiveness are supported by a series of measures and correspond to the energy planning objectives. More specifically, the main areas of interest are:

I. Use of new RES technologies to meet the needs for generation, transmission, distribution and storage of electricity, to be achieved by:

- Continuously increasing the competitiveness of RES energy generation technologies in terms of generation costs.
- Increasing the efficiency and flexibility of power plants that use conventional fuels as a consequence of the new role that they have to play in the electricity market and the continuous increase in GHG emission allowance prices.
- Increasing the overall needs for electricity system flexibility and energy storage.
- Optimally integrating RES technologies in distribution networks in direct connection with consumption, as well as integrating information and communication technologies.

II. Use of new RES technologies to meet heating and cooling needs, to be achieved by:

- Increasing the competitiveness of heat pumps and of all low-enthalpy technologies in general.
- Optimally integrating RES technologies for heating and cooling purposes in the building sector, in particular to the extent that new buildings are to be nearly zero-energy buildings in the following decade.
- Ensuring further penetration of solar energy technologies in all uses.
- Using biomass efficiently.

III. Improvement in energy efficiency, to be achieved by:

- Reducing the cost of construction of new buildings and of upgrading existing into nearly zero-energy buildings.
- Adopting new technologies and methods of increasing energy efficiency in the tertiary sector, in industry and in the public and broader public sector.
- Reducing network losses and optimising network operation.

IV. Transformation of the transport sector, to be achieved by:

- Reducing the cost of small-scale electricity storage technologies and of electromobility.
- Developing smart infrastructures for electromobility.
- Producing second-generation biofuels.
- Reducing the cost of all alternative fuels that can be used in transport.

V. Reduction in GHG emissions, to be achieved by:

- Ensuring the maturation and integration of low-emission technologies in industry, in iron and steel plants in particular.
- Ensuring the capture, storage and utilisation of carbon dioxide from power generation plants using conventional fuels and industrial uses.
- Applying advanced techniques in rural economy, forests, etc.
- Developing integrated consumption management and monitoring tools for residential buildings and business premises, to change the energy consumption pattern and reduce the overall carbon footprint.

2.8 Key issues of cross-border interest

Key issues of cross-border interest in the fields of energy and climate focus on the transfer of know-how on policies and measures, on the recognition and planning of the implementation of new cross-border energy infrastructures or on enhancing infrastructures already in operation, on cooperation to implement innovative and pilot energy projects, on the functioning of energy markets, on cooperation between information systems, and on cooperation in the context of financing programmes.

Their implementation often takes place in the context of cross-border agreements and memoranda of cooperation/understanding. These cross-border partnerships and agreements are planned and finalised in close cooperation and synergy with the Ministry of Foreign Affairs.

Chapter 3 POLICIES and MEASURES

3.1 Governance mechanism for the implementation of the NECP, maximising synergies between its cross-sectoral modules

To attain the NECP objectives by 2030, it is necessary to put in place a cohesive mechanism for ensuring both the effective implementation of the policy measures included in the present NECP and the redrafting of existing measures and the drafting new ones in order to attain the objectives and maximise synergies between cross-sectoral policies.

The key characteristics of the proposed governance for the implementation of the NECP are developed on six main policy governance axes (PGA1-PGA6), as shown in Figure 3 and further analysed below.

PGA1: Single governance framework

PGA2: Continuity and consistency in the implementation of policy measures by institutional bodies

PGA3: Monitoring mechanism for the implementation and performance of policies and measures

PGA4: Strategic reference framework for development programmes to be planned and adopted by the network operators and the regulator

PGA5: Development and implementation of financing mechanisms and programmes for the attainment of the objectives

PGA6: Information and training actions for energy transition and addressing climate change

Figure 3: Governance policy axes to attain the NECP objectives in the period 2021-2030.

The governance mechanism as a whole will incorporate, also as a procedure, the development of certain critical performance indicators for the cross-sectoral and sectoral measures and policies and how these will contribute to the attainment of the policy priorities set out in this chapter per theme. These indicators will take into account, inter alia, the degree of implementation in relation to the initial scheduling of policies and measures, the cost-benefit ratio of energy and climate objectives and their potential degree of interdependence and complementarity.

3.1.1 Governance policy axes

The development of a **single governance framework**, to monitor and assess in a cohesive manner both all the policy measures laid down in the present NECP by 2030 and the stakeholders' contribution during their implementation is a key priority. This governance framework aims to ensure the centralised and integrated monitoring of the implementation of policy measures and ensure the stakeholders' contribution during their implementation with a view to attaining the NECP objectives.

This governance framework will help facilitate cooperation and communication between stakeholders both in each Energy Union dimension separately and across the six different dimensions, thus ensuring maximum synergies between the policy measures implemented under all Energy Union dimensions.

The Government Committee for Energy and Climate set up and established on the basis of Council of Ministers Act No 31 of 30 September 2019, as well as its support bodies, will play a pivotal role in developing and implementing this governance framework.

The Government Committee' functions include:

- ✓ Formulating the national priorities and the methodology and guidelines for Greece's energy planning, as well as drawing up the NECP.
- ✓ Analysing and updating the energy system development scenarios to be looked into.
- ✓ Planning and promoting proposals for energy policies and actions and making recommendations on taking corrective measures in the event of deviations.
- ✓ Providing guidelines to institutional bodies.

Please note that the single governance framework will apply both to institutional bodies involved in the Government Committee and bodies which, despite not being involved, play an institutional role in implementing specific policy measures at business community and technical activity levels. The required ratification of the NECP by the Government Council for Economic Policy will ensure continuity at a governance level and the commitment of the institutional bodies involved in the Inter-Ministerial Committee for Energy and Climate to cooperate with a view to attaining the specific objectives.

Furthermore, stakeholders should take into account the provisions of the NECP in their own development policies in order to contribute towards the smooth and effective implementation of the policy measures laid down in the NECP.

To that end, a coordination mechanism will be developed, consisting of committees or groups intended to ensure the relevance of other related national strategies, such as waste management, circular economy and climate change adaptation.

Further details will be provided on the implementation of the single framework by laying down specific procedures to be followed explicitly throughout the period 2021-2030. For example, these procedures will relate to monitoring, controlling and supervising the implementation of the NECP policies and measures and assessing the progress made in attaining the national objectives. The functions and obligations of all bodies involved, except those already explicitly laid down as functions and obligations of bodies and authorities under the national and, in particular, EU legislative framework, will be laid down for each procedure individually, in order to strengthen the supervision and coordination of the relevant actions and to highlight each party's contribution to the national effort, thus allowing for proper transparency and monitoring of the degree of performance in each area of responsibility.

The implementation of the single governance framework will result in **ensuring continuity of the policies and measures to be implemented and consistency of both public and private institutional bodies** involved in the implementation of these policies and measures. Moreover, the policies and measures will be redrafted subject to uniform rules, taking into account the framework used to draw up the existing NECP, thus ensuring the effective attainment of its objectives under any circumstances. Apart from that, these policies and measures will be used as a basis for identifying and highlighting the need for synergies and complementary actions in all activity sectors of the Greek economy.

A fundamental component of the single governance framework is developing an integrated **monitoring mechanism** for the policies and measures under implementation. This mechanism will include procedures for ongoing monitoring of both the attainment of the individual NECP objectives and the performance and impact of each policy measure individually, including by the use of relevant critical performance indicators, as explained above.

On the basis of Council of Ministers Act No 31 of 30 September 2019, specific functions are assigned to the NECP monitoring working group in the context of the monitoring mechanism to be developed.

The working group's responsibilities will include the following, inter alia:

- ✓ Recording the progress made in implementing the Energy and Climate Plan.

- ✓ Notifying to the Inter-Ministerial Committee any deviations in implementing the approved measures and policies and attaining the intermediate objectives.
- ✓ Proposing appropriate new measures or modifying existing ones with a view to attaining the NECP objectives.

To develop the monitoring mechanism, it is necessary to implement specific actions, such as defining a methodology for measuring the performance of each policy measure in terms of attaining the objective as well as in terms the socio-economic impact, planning a procedure for collecting the data necessary for measuring performance, and determining the estimated positive and negative deviation compared to the objectives for 2030. Please note that all existing administrative data sources will be used and integrated into a standardised procedure, thus making sure that the collection of necessary data and the associated calculations are carried out accurately and transparently.

The setting of indicators intended to help carry out the above operations will constitute a significant component of the monitoring mechanism. In accordance with the practice followed in the context of the Corporate Pact for Development Framework (ESPA), these indicators may be broken down into output indicators, which are used to measure the progress made in connection with major actions, and result indicators, which are used to express the change made in the context of a policy priority. In any case, these indicators will satisfy concrete quality criteria (e.g. clarity, measurement of values associated with specific policies, use of commonly accepted methodologies). The use of indicators which have already been used by international organisations (Commission, OECD, UN, etc.) can provide the basis for the final selection and formulation of all NECP indicators.

A vital component of the monitoring mechanism is the process of redrafting existing measures marked with lower performance levels or promoting more intensively those marked with much higher performance levels. In any case, assessing the policy measures under implementation is crucial for taking, in a timely manner, necessary decisions on the mix of existing or new policies that need to be launched in order to prevent putting the attainment of the NECP objectives at risk. The assessment of policy measures will be based on a specific methodological approach, in the context of which the socio-economic impact will be assessed, in addition to the contribution made towards attaining the objectives. That is why it is vital to ensure the **methodological cohesion of the policies and measures planned**, also including a detailed assessment of their qualitative and qualitative impact, which has already been conducted for all the measures planned.

Following the assessment of policy measures, training will be provided for different energy sector development scenarios by 2030, to estimate the level of attainment of the energy and climate objectives set and detect potential deviations on an annual basis. These scenarios will be assessed by developing a specific methodological approach, based on the application of a multi-criteria analysis method and taking into account the socio-economic and environmental impact identified in the context of implementing the policy measures. This methodology aims to identify the most likely energy sector development scenario and to ensure the attainment of the objectives set by potentially adopting that scenario, thus ensuring maximum socio-economic and environmental benefits.

Moreover, the objectives set are quantified and cost-accounted and include intermediate sub-objectives even at a sectoral level, to allow for continuously monitoring their implementation and contribution. The objectives are also linked to the adoption and performance of a specific mix of policies and measures.

Lastly, all the annual reports on the implementation of the NECP, as required by the relevant regulation, will be based solely on the findings of the monitoring mechanism, resulting from the implementation of its individual procedures. The milestone procedures will be carried out in 2023, 2025 and 2027, when the progress made will be verified at a European level.

Apart from that, the NECP will be used as a basis for developing a **strategic reference framework** for long-term development programmes to be planned and submitted by the relevant network operators to the regulator, taking due account of both the policy mix in place each time for attaining the NECP objectives, on the basis of the monitoring mechanism, and the infrastructure development obligations. As regards in particular the infrastructures planned and the corresponding long-term development plans of the relevant operators, the aim is to monitor the relevant NECP objectives and help attain them. **The essential objective of this governance axis is for the NECP to be used as the national reference plan for all development programmes of national bodies and organisations in respect of energy and climate issues, to be taken into account in elaborating strategic and development programmes in all economic sectors and to be supported by an appropriate legislative framework, in the context of the functions of all stakeholders.**

Naturally, in the course of implementing the NECP, account will be taken of any deviations, firstly for the above bodies to take possible corrective measures and secondly to ensure the energy supply of Greece.

A relevant model will be used in designing and implementing **financing mechanisms and programmes**. More specifically, the ultimate objective of this framework is to utilise existing resources and mechanisms in order to launch the implementation of the mix of policy measures initially envisaged in the context the NECP or those to result from the assessment procedure through the monitoring mechanism, with particular emphasis placed on designing appropriate financing mechanisms in the new programming period 2021-2027, as well as on ensuring the optimal utilisation of other financing funds.

In any case, these financing mechanisms and programmes will be designed on the basis of the same guidelines as those set out in the context of the NECP, including, inter alia, maximising the expected leverage of resources, using available public funds more efficiently, adopting innovative funding tools, ensuring more active mobilisation of the domestic financial sector and maximising synergies between different policy objectives.

Finally, although not falling clearly within the remit of the governance mechanism, emphasis will also be placed on the central planning and implementation of specific **information and training actions for all consumers**, to get them acquainted with the requirements and challenges of energy transition and of addressing climate change. This axis aims, through specific actions, to provide comprehensive information and training to consumers and raise awareness among them in energy and environmental issues, for them to adopt eventually an environmentally friendlier lifestyle and to choose environmentally friendly technologies through specific decision-making criteria.

In any case, consumers should play a more active role in energy and climate issues and develop social and environmental awareness, whereas it is important that the relevant effort should be planned centrally, also including complementary sectoral actions for the optimal application and implementation of the measures and policies planned under the NECP.

Active society participation in the transition is a prerequisite for its successful outcome. In this context, the above actions will focus, inter alia, on the opportunities arising in different areas, such as demand response, own consumption and partnerships.

Furthermore, the relevant actions will also focus on social acceptance at a local level, with regard to the development of new RES power plants and energy infrastructures. The electronic tools envisaged under the NECP policy measures for monitoring the licensing framework for RES will further strengthen transparency in the development of new projects by region and will allow for realistically recording the characteristics of projects under licensing and development.

Given the interest of consumers and the need to inform them responsibly of the need to change the consumption model, awareness-raising and information actions will be handled uniformly and as a whole in respect of such issues as recycling and circular economy.

3.2 Climate change, emissions and removals of greenhouse gases

The definition of policy measures on climate change, for reducing GHG emissions and gaseous pollutants in particular, as envisaged in the context of the National Emissions Ceilings (NEC) Directive (2016/2284/EU), in the period 2021-2030 aims to cover eight different policy priorities (PP1.1-PP1.10), shown in Figure 4.

PP1.1: Attaining a climate neutral economy, through lignite phase-out, promoting RES in Greece's energy mix and interconnecting the autonomous island systems

PP1.2: Actions for adapting to climate change

PP1.3: Actions for reducing emissions in the transport sector

PP1.4: Actions for reducing emissions of fluorinated gases

PP1.5: Actions for reducing emissions in the agricultural sector

PP1.6: Waste management strategy plans

PP1.7: Circular economy strategy plans

PP1.8: Urban bioclimatic restructuring and smart cities

PP1.9: Involvement of the financial sector

PP1.10: Actions for reducing emissions in the industrial sector

Figure 4: Policy priorities for policy measures to reduce greenhouse gas emissions in the period 2021-2030.

The 10 policy priorities aim to attain the objective set in the context of the Paris agreement to keep the increase in global average temperature well below 2 °C, and if possible to limit it even further to 1.5 °C, above pre-industrial levels, as well as to fulfil the relevant Union commitment to reduce GHG emissions by at least 40 % by 2030 compared to 1990. They also aim at incorporating in the national plan the EU's strategic vision for a climate neutral economy by

2050[10].The policy measures that have been specified in the above policy priorities are analysed separately in the following sections.

3.2.1 Policies and measures to attain the objective

PP1.1 Attaining a climate neutral economy, through lignite phase-out, promoting RES in Greece's energy mix and interconnecting the autonomous island systems

Making the economy independent of lignite, which is a polluting fuel, is a key priority for the Greek government. Therefore, in September 2019 the Prime Minister announced that Greece would phase out lignite by 2028.

This objective is fully in line with the Union's ambition to make Europe stand out as the first climate neutral continent by 2050, as well as with international energy developments. It also puts Greece at the forefront of the combat against climate change and of energy transition.

The reasons why **lignite phase-out** is imperative are environmental due to climate change, as well as financial due to the increase in emissions trading prices.

This transition to a lignite-free era is feasible and can be supported thanks to Greece's strong RES potential, which is our fundamental national energy resource in the energy mix of the future.

The shutdown of all lignite-fired plants by 2028 will take place in a coordinated and responsible manner. The government's top priority is to move to the post-lignite era in a way that is fair for Western Macedonia and Megalopolis.

The table below details the timeframe for the shutdown of lignite-fired plants that are currently in operation, which is to be completed by the end of 2023.

[10] European Commission - Clean Planet for all: A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52018DC0773&from=EN

Table 14: Timeframe for shutting down lignite-fired plants

Lignite-fired plant	Rated capacity	Year of shutdown
Kardia 1	275	2019
Kardia 2	275	2019
Kardia 3	280	2021
Kardia 4	280	2021
Agios Dimitrios 1	274	2022
Agios Dimitrios 2	274	2022
Agios Dimitrios 3	283	2022
Agios Dimitrios 4	283	2022
Agios Dimitrios 5	342	2023
Amyntaio 1	273	2020
Amyntaio 2	273	2020
Florina/Meliti	289	2023
Megalopolis 3	255	2022
Megalopolis 4	256	2023

Therefore, an integrated, multi-faceted and front-loaded plan (Just Development Transition Master Plan) will be developed and presented in mid 2020 under the supervision of the Inter-Ministerial Committee, to serve as a roadmap towards the post-lignite era. The Inter-Ministerial Committee was set up and established in December 2019, also laying down the priorities for drawing up the Master Plan and the timeframe for the actions included therein.

The procedure for drawing up the Just Development Transition Master Plan will be coordinated and open to local communities. Consultation will take place at an institutional level with all local bodies involved (regions, municipalities, chambers), whose active participation is a necessary prerequisite for the successful outcome of the project.

In drawing up the programme for shutting down lignite-fired plants, account was taken of the unhindered operation of the district heating systems used to cover thermal needs in the energy areas. In this context, all alternatives, such as the development of a natural gas network in these areas, will be looked into.

The Just Development Transition Master Plan will include a set of measures and provisions including, inter alia: investment and tax incentives, new infrastructures, new technologies, utilising local natural resources, supporting agricultural production and tourism, retraining workers, securing existing jobs and creating new ones through flexible developmental transformation and through growth in all production sectors.

In this direction, studies and expert opinions from different independent bodies with experience and expertise in these issues will be used to ensure the best possible setup of the contributions.

Of course, the fact that the Just Development Transition Master Plan will be presented in 2020 does not mean that no targeted interventions have already been made for the benefit of the transition areas.

The Greek government does have the political determination and the required know-how to utilise resources that are readily available at a national level and to claim increased funds from EU financing funds.

Necessary initiatives have been taken to disburse to the energy areas the Public Power Corporation's development fee of approximately EUR 130 million, owed since 2014, and these areas will continue to receive funding from the revenue of the auctioning of GHG emissions allowances through the Green Fund.

Also, under the new European budget for the period 2021-2027, an effort will be made to claim increased funds from the Union's Just Transition Fund, making sure that the areas of Western Macedonia and Megalopolis will meet the funding criteria by having mature projects in place. The role of the European Investment Bank, aspiring to become a 'Climate Bank', in this respect is also important. Moreover, funds from such programmes as Horizon, Connecting Europe Facility and Invest EU will support this effort.

Lignite phase-out is a major change to the national energy map, but also a huge opportunity for Greece. The spirit of innovation that was ushered by the use of lignite will be passed on to the clean forms of energy and the new energy mix of the 21st century.

All measures for the penetration of RES in power generation, heating and transport contribute to this objective. Given that natural gas, although a fossil fuel, has lower GHG emissions than conventional fuels, the substitution of diesel or lignite with natural gas is an intermediate policy step forward in reducing GHG emissions. Promoting the use of gas in specific areas of final consumption, in replacement of petroleum products, is also a key priority.

Additional reductions in GHG emissions are expected from the interconnection of autonomous island systems with the mainland system, where the operation of local, highly polluting power plants will gradually cease, as detailed in other sections below.

Lignite phase-out

The objective of phasing out lignite by 2028 is fully in line with the Union's ambition to make Europe stand out as the first climate neutral continent by 2050.

The government's top priority is to move to the post-lignite era in a way that is fair for Western Macedonia and Megalopolis.

An integrated, multi-faceted and front-loaded plan (Just Development Transition Master Plan) will be presented in mid 2020, to serve as a roadmap towards the post-lignite era, including clear timeframes for the implementation of specific actions.

The Greek government does have the political determination and the required know-how to utilise resources that are readily available at a national level and claim increased funds from EU financing funds, from the Just Transition Fund in particular.

PP1.2. Actions for adapting to climate change

Apart from mitigating emissions, the second pillar of international climate policy, as set out in the United Nations Framework Convention on Climate Change (UNFCCC), is climate change adaptation. Climate change adaptation measures concern both natural and human systems and are drafted on the basis of vulnerability estimates for ecosystems, economic sectors and population groups.

The climate change adaptation process is an integral part of developing Greece’s growth model and protecting social cohesion. In this context, it is a priority to prepare for the potential impact of changing circumstances on production sectors, as well as to set up an appropriate framework for identifying the sectors and activities that will create new opportunities under these circumstances. In the field of investment, medium- and long-term investment in particular, the relevant planning should take into account environmental risk and the contribution of each investment to the broader adaptation strategy.

At a legislative level, it is necessary to include the climate change adaptation dimension in the environmental, physical planning and town planning legislation. The relevant revision of the existing institutional framework covers, inter alia, the general framework for physical planning and sustainable development, the regional frameworks and the special physical planning frameworks for tourism, RES, aquaculture, as well as the water management plans of water districts and then the lower levels of physical planning for urban mobility (sustainable urban mobility plans - SUMPs).

The necessary climate change adaptation measures include interventions aimed at the preservation of biodiversity, more efficient use of water resources, forest management, adjustment of building and infrastructure construction standards to current or potential future climatic conditions, protection of coastal cities from rising sea levels, reducing urban sprawl, combating the urban heat island effect, mobility management, as well as a number of actions in various areas such as agriculture, fisheries, energy, tourism and health. Implementing these measures requires the transfer of knowledge from the public administration to the competent bodies in each case, in respect of new opportunities and requirements in policy planning and implementation.

The National Strategy for Adaptation to Climate Change (NSACC)[11] lays down the overall objectives, guidelines and tools for implementing necessary climate adaptation measures at national, regional and local levels. The NSACC proposes adaptation policies in a broad range of areas in respect of the environment, economy and society which are expected to be affected considerably by climate change in Greece: tourism, energy, infrastructure and transport, health, built environment, extractive industry, cultural heritage, agriculture and stock farming, forest ecosystems, biodiversity and ecosystems, aquaculture, fisheries, water resources, coastal areas and insurance sector[12]. The key NSACC aims are, inter alia, to contribute to better decision-making through the dissemination of information and scientific data on climate change adaptation and to promote a set of adaptation actions and policies in all sectors, focusing in particular on the most vulnerable ones. An additional aim is to set up a mechanism for monitoring and assessing adaptation actions and policies, as well as informing and raising awareness among people.

The NSACC sets out the strategic framework and the relevant guidelines for the development and implementation of the regional action plans for climate adaptation. In drawing up the regional action plans for climate adaptation, basic selection, prioritisation and time scheduling of appropriate climate change adaptation actions and measures is carried out, also based on the specificities of each region.

The development of the 13 regional action plans for climate adaptation is underway, more than 50% of these plans have been completed already, and the relevant process is expected to be completed for all regions in 2020. It should be stressed that, given the fact that the scope of the relevant measures often exceeds administrative boundaries and requires a cross-regional approach, e.g. in respect of river basins, some of the actions need to be planned at a climate zone level.

An ever-increasing number of local authorities have started developing local adaptation plans. More than 50 Greek cities have signed the 'Covenant of Mayors on Energy and Climate for 2030', to make their respective areas more resilient to climate change. Also, the programme for preparing local physical plans, which is being drafted currently and is expected to cover all municipalities in Greece within 6 years, provides that each one of these plans will include a

[11] Its drafting is provided for by Law 4414/2016

[12] These are sectors identified on the basis of the report 'The environmental, economic and social impact of climate change in Greece', published in 2011 by the Climate Change Impact Assessment Committee of the Bank of Greece.

special section laying down climate change adaptation measures at municipal and municipal district levels.

The completed project 'LIFE-IP AdaptInGR - Boosting the implementation of adaptation policy across Greece', which is co-financed by the Commission, is the most important project in Greece's effort to adapt to climate change impact. The project aims to strengthen the implementation of the national strategy and of the 13 regional climate change adaptation plans during the current first climate change adaptation cycle (2016-2025) and to prepare for the transition to the second adaptation cycle (from 2026) with appropriate actions at national, regional and local levels.

More specifically, the project aims at:

- ✓ providing education and training to the human resources of the bodies entrusted with the implementation of climate change adaptation actions and policies;
- ✓ setting up an effective mechanism for monitoring, assessing and updating climate change adaptation actions and policies;
- ✓ implementing demonstration projects in 3 regions and 5 municipalities in Greece, in priority areas for climate change adaptation, such as flood risk management, coastal zone management, prevention of and response to forest fires in areas prone to increased risk of drought, water resources management, town planning and urban bioclimatic restructuring;
- ✓ providing information to and raising awareness among people and social partners;
- ✓ mobilising complementary Union and national funds, as well as other financial instruments, to implement climate change adaptation actions;
- ✓ disseminating good practices in Greece, Eastern Mediterranean and the EU;
- ✓ assessing and reviewing the national strategy and regional plans for climate change adaptation, in preparation for the second cycle of implementation of adaptation policies.

With regard to the impact of climate change on cultural heritage, Greece has undertaken an international initiative in cooperation with UNESCO and the World Meteorological Organisation (WMO) in order to identify state-of-the-art solutions for monitoring and protecting the world cultural and natural heritage and strengthening its resilience by the use of new technologies.

PP1.3. Actions for reducing emissions in the transport sector

Transport is a major source of GHG emissions, and therefore interventions are required to contribute substantially to the transition to low-emission mobility, in line with the 'Europe on the move' proposals. Policy measures in the transport sector, for promoting RES and improving energy efficiency, are important in this direction. Examples include the promotion of electromobility in road and rail transport and the supply of power to ships during berthing through the development of necessary infrastructure.

GHG emissions in transport may also be reduced by the use of natural gas either in the form of compressed natural gas (CNG) for passenger cars and light vehicles (in cities in particular) or in the form of liquefied natural gas (LNG) for heavy vehicles (on national roads in particular). Other examples of such measures are promoting alternative fuels, including the use of biomethane (in replacement of, or mixed with, natural gas), and the elaboration of sustainable urban mobility plans. Moreover, promoting biofuels and using electricity will contribute to reducing emissions in the transport sector.

Urban mobility management is a key aspect of improving transport organisation in cities and regions and contributes significantly to strengthening sustainable mobility and carbon-free transport. Mobility management supports the introduction and use of state-of-the-art and environmentally friendly technologies (bicycles, electric cars, expansion of public transport, micro-mobility vehicles, etc.), to make possible the utilisation of its full potential and to avoid counterproductive developments. Measures to support cities and municipalities in mobility management and awareness-raising consist in strengthening accessibility and pedestrian mobility (setting up greenways and blueways, walkways, soft traffic roads, etc.), promoting the use of bicycles (implementation and improvement of infrastructures), parking policy, change to the supply chain model (cargo bikes, collective transport, operating hours, etc.), policy for reducing the use of private cars (ban on parking/traffic in specific areas, etc.), setting up pockets of reduced vehicle traffic (superblocks, living streets, etc.), promoting car rental and sharing systems, strengthening municipal services (school buses, public transport, etc.), promoting the use of micro-mobility vehicles, strengthening multimodal mobility, improving park and ride spots, improving ICT-based infrastructures and promoting sustainable and safe transport systems.

Lastly, physical planning and town planning contribute to reduced GHG emissions by promoting more cohesive urban forms and methods of organisation for cities and their functions, in line with the compact city model, through policies for strengthening density and proximity and mixed land uses, combating urban sprawl, managing, protecting and upgrading the public space, strengthening housing, reconstructing degraded areas, ensuring the energy upgrading of buildings, bioclimatic design (e.g. in a way that contributes to reduced travel by the use of passenger vehicles and a lower carbon footprint), as well as by setting up green spaces, increasing vegetation levels in urban greenery areas and enhancing water bodies (streams, rivers, lakes), which contributes to the natural absorption of pollutants and the improvement of bioclimatic conditions, thus leading to reduced energy needs.

PP1.4. Actions for reducing emissions of fluorinated gases

A combination of policy measures will be implemented to reduce fluorinated gases not only through preventing leaks and emissions but also through controlling the use of fluorinated gases. Examples of measures include discontinuing the production of new domestic refrigerators and freezers that use fluorinated gases with GWP>150 and the production of fire protection apparatuses that contain HFC-23 fluorinated gases, providing training and certification for technicians carrying out work that involves fluorinated gases, installing leak detection systems in large cooling, air-conditioning and fire protection systems, and using motor vehicles that do not use fluorinated gases with GWP>150.

PP1.5. Actions for reducing emissions in the agricultural sector

The National Strategy for Adaptation to Climate Change places particular emphasis on agriculture and forestry in terms of sectoral climate change adaptation policies. It should be stressed that, despite the primary role of this strategy being to make Greece more resilient to climate change impact, priority is given to synergies between adaptation and mitigation actions, through the conservation and **sustainable use of edaphic resources and land management practices**.

The revised Common Agricultural Policy (CAP) introduces specific measures in the context of Green Direct Aid by promoting **sustainable food production, sustainable farm management** and environmentally and climate friendly practices and methods. The measures to be implemented aim at preventing desertification of rural land, improving water management, reducing the intensity of natural resources management, optimising the use of agricultural land, reducing the use of fertilisers and improving animal waste management. The promotion of organic farming and the increase in organic crops are also key priorities under the next Rural Development Programme, contributing to reduced GHG emissions. Moreover, the Rural Development Programme will promote a more intensified implementation of forestation, which will also increase the level of absorption in the land use, land-use change and forestry (LULUCF) sector. On the basis of the most recent information reported by Greece under Articles 12, 13 and 14 of Regulation (EU) No 525/2013 on a [13]mechanism monitoring, the removal of carbon dioxide emissions (net sink) is expected to continue in the LULUCF sector until 2040.In respect of the share of the different land use categories in GHG emissions/removals, forests and forest areas play the most important role in the entire sector, with a share of approximately 56% of total emissions/removals (absolute values). This trend in the forest category is expected to continue in the period up until 2050. The different policies and measures currently in force, as laid down in the Rural Development Programme, the Public Investment Programme, the ordinary budget and the Special Fund for Forests (Green Fund) of the Ministry of Environment and Energy, are expected to continue financing and supporting actions in this area in the future, thus further mitigating climate change impact. Given the overall financial difficulties in Greece, the policies implemented and adopted and the measures taken aim to maintain and strengthen forest services, in order to preserve and strengthen biodiversity, increase the contribution of forests towards climate change mitigation and make forests more resilient to climate change impact.

Moreover, the National Strategy for Forests was published recently by Ministerial Decision No 170195/758/2018 (Government Gazette, Series II, No 5351/28.11.2018). The National Strategy for Forests lays down the principles and guidelines of forestry policy for the period 2018-2038 and sets out the specific objectives under this policy and the necessary resources and means for implementing it. It has also adopted the 'Mediterranean Forestry Model' in the management of forest ecosystems, adapted to biotic and abiotic conditions in Greece at national and regional levels, which includes a clear technical and economic plan and provides for increased flexibility in order to strengthen the multifunctional role of forest ecosystems. Articles 5 and 6 lay down the three horizontal and four vertical axes, respectively, including their general objectives, courses of action and monitoring indicators. Climate change is the second vertical axis, and the National Strategy for Forests stresses the obligation to interconnect with relevant national, international and EU strategies for forest ecosystems (Article 8). The National Strategy for Forests will be implemented through the Action Plan for Forests. The implementation of the Action Plan for Forests falls under the remit of the Ministry of the

[13] https://cdr.eionet.europa.eu/gr/eu/mmr/art04-13-14_lcds_pams_projections/projections/envxkn1eg/

Environment and Energy and of jointly competent ministries and bodies. Furthermore, actions will be promoted for the assessment of the vulnerability of **forest ecosystems to climate change**, for management aimed at adapting forest ecosystems to climate change, for mitigating climate change by increasing carbon capture and storage in forest ecosystems and for **addressing extreme phenomena** (e.g. forest fires). More specifically, emphasis will be placed on coordinating actions for preventing and combating forest fires, protecting from insects and diseases and preventing flooding and water scarcity.

PP1.6. Waste management strategy plans

The waste management sector is an integral part of the national energy and climate planning. Waste that generates large quantities of GHGs requires appropriate treatment in order to be recycled or to be used for energy generation, thus contributing to the combat against climate change and the promotion of circular economy.

Bioeconomy, being an important component of sustainable economy, can substitute fossil fuels with renewable resources. For example this can include recyclable organic base products and compostable biodegradable products.

In this direction, actions are being promoted for the integrated management of organic waste, consisting in separate waste collection at the source, separate waste disposal throughout Greece and aerobic or anaerobic waste treatment which can produce compost, digestate or other material and/or ensure energy recovery.

Also, the separate collection of organic waste is a measure that can contribute to the attainment of the UN sustainable development goals, in particular reducing per capita food waste by 50% by 2030. The objective will be attained to a lesser extent through responsible consumption and reduction in food waste and to a greater extent through increased recycling of organic waste and energy recovery from this waste stream.

Provision has also been made for strengthening and upgrading recycling infrastructures, to cover the entire territory of Greece. The EU recycling objective of 60% by 2030 will be attained by supporting local authorities and strengthening the separate collection of four different streams of solid waste (plastic, paper, glass and metal). In the context of a comprehensive waste management plan in Greece, a number of waste treatment plants are to be set up in the coming years with a view to reducing treatment residues and diverting more than 90% of waste from landfills.

In the context of (a) the National Waste Management Plan (NWMP) and (b) the Regional Waste Management Plans (RWMPs), integrated plans will be prepared for the treatment of industrial waste, the setup of landfills for hazardous waste in conformity to the strictest EU standards and the systematic collection and management of agricultural and livestock waste.

Consideration will also be given to specific interventions aimed at better controlling the management of health care waste and the uncontrolled disposal of excavation, construction and demolition waste, as well as of all alternative sorting systems.

Please note that energy generation from secondary RDF (Refused Derived Fuel) or SRF (Solid Recovered Fuel), i.e. residual fuel from the management of mixed municipal waste and waste packaging in waste treatment plants, is compatible with:

- waste management and utilisation by the use of state-of-the-art circular economy technologies;
- circular economy requirements, as the energy utilisation of residual fuel ranks above landfilling in hierarchy of mixed municipal waste management;
- the Commission's guidelines for diverting more than 90% of waste from landfills by 2035.

RDF/SRF can be used as secondary fuel in energy-intensive industries (cement, paper, metallurgy) in boilers for steam production or district heating. The advantages of using it are: (a) it is easy to transport and store; (b) it can be burnt in conventional solid fuel burners; (c) its production can be combined with mechanical sorting; (d) it has stable quality as fuel; (e) it has high thermal efficiency; (f) it causes low environmental impact, as CO_2 emissions from the its use are lower than those of fossil fuels because RDF/SRF contains a significant percentage of biomass.

Different management will be used and specific measures will be taken to address seasonality of waste, aiming to fully cover island areas during the tourist season.

Waste management

The National Waste Management Plan (NWMP) and the corresponding Regional Waste Management Plans (RWMPs) are under review and will intensify a number of integrated waste management measures, always in line with circular economy requirements. The NWMP and the RWMPs will in the context of the new package of waste directives and of implementing the National Action Plan for Circular Economy, ensure a realistic plan for complying with the EU requirements.

PP1.7. Circular economy strategy plans

Based on optimised use of resources and extended product lifecycle, circular economy is a catalyst for productive reconstruction and has an important environmental dimension. Similar focus must be given to bioeconomy issues, where it is necessary to develop strategy plans, for the attainment of long-term climate objectives in particular. The transition to more sustainable production and consumption patterns is essential for attaining the global objectives for nature conservation and halting the loss of biodiversity, as well as for ensuring responsible production and consumption, reducing the environmental footprint of products and increasing their lifecycle. Extraction and processing of resources account for more than 90% of the impact on global biodiversity and water and approximately half of the global GHG emissions. Product ecodesign in production, the establishment of financial incentives for circular economy and industrial symbiosis, the elaboration of criteria for adopting green and circular public procurement, sharing economy and the promotion of innovative solutions that create added value, ensure the sustainability of resources and prolong the lifecycle of the products and services provided are part of circular economy. The sectors of bioeconomy, biomass, food and fertiliser, excavation and demolition waste, plastics, textiles and water reuse are areas of focus for the national strategy, which can contribute to the creation of sustainable work cycles, modern and quality jobs and improved quality of life through the provision of resilient and innovative products and services.

The contribution of circular economy to improved competitiveness is considered to be very important, and therefore it is necessary for promoting specific actions reflected in the National Circular Economy Strategy, adopted by the Central Economic Policy Council on 17 April 2018.

National Strategy actions include, inter alia, the implementation of the national waste prevention programme, the reduction of food waste, the adjustment of the framework for construction of public and private projects by adopting green and circular criteria, the facilitation of the processing and use of secondary raw materials, the development of criteria for the product ecodesign, the promotion of the use of waste as secondary fuel in industry, the creation of an institutional regulatory framework which will facilitate the production of biomethane from organic waste and its feeding into the natural gas network or its use as transport fuel, as well as the management, utilisation and re-use of waste.

Circular economy can increase productivity and reduce dependence on non-renewable resources and critical raw materials by increasing the use of secondary materials and waste, as productive resources and useful raw/other materials, by promoting the use of treated hazardous and non-hazardous waste as secondary raw materials and secondary fuels in industry, applying best available techniques under the Directive 2010/75/EU on industrial emissions, thus adding a sustainability dimension to the production model. Under such a model, resources are used for longer periods and their maximum value is increased, and end-of-lifecycle materials are recovered and recycled. This is a more effective and environmentally friendly alternative to the traditional linear economy in which we exhaust, manufacture, use and dispose of resources. Moreover, circular economy is a necessary prerequisite for reducing global GHG emissions and thereby mitigating climate change impact in a way that conforms to the Paris Agreement objectives, while at the same time contributing to the attainment of the UN sustainable development goals (SDGs). Given the anticipated environmental, climatic, social and financial benefits, circular economy is intensively promoted not only by the Commission and other EU institutions, but also by an increasing number of Member States and cities, attracting more and more attention from the business community and from public and private financiers. Circular economy clearly goes beyond waste management and recycling and provides the framework for the development of new responsible business models to ensure to sustainable development and create shared value for all.

Apart from that, we should also refer to other initiatives in Greece for promoting the transition to circularity, such as the establishment of energy communities and Greece's voluntary commitment in the context of the UN summit for promoting green growth through circular economy, towards implementing the UN sustainable development goals.

A key priority in the context of the transition to circular economy is establishing an appropriate institutional framework and incentives for industrial symbiosis. Given now an appropriate framework in place, laying down criteria and technical specifications for the setup of new industrial parks and industrial areas and the modernisation/upgrading of existing ones can contribute significantly to the attainment of industrial symbiosis in Greece, which will ensure financial, environmental and social benefits, in coordination with community and international needs. The appropriate siting of industrial activities, combined with the necessary regulatory interventions and financing instruments for having waste from one industry used as raw material by another is a sufficient and necessary condition for reducing the environmental footprint of industrial activities, reducing dependence on conventional resources, saving energy in industry, encouraging energy recovery and eventually reducing the carbon footprint of industrial activities, thus contributing to the combat against climate change.

Application of basic circular economy principles

The sustainable development model, which focuses on circular economy principles, contributes decisively towards addressing climate change, ensuring economic development through new innovative investment, creating quality jobs and upgrading production in Greece through industrial symbiosis models and infrastructure modernisation. By adopting such a model, Greece will improve its environmental performance and, based on the precautionary principle, will be able to address the environmental challenges caused by climate change in a holistic manner.

In this context, the transition to circular economy is a core element of Greece's development strategy, and its implementation includes, inter alia, a four-year strategic plan that covers the entire range of the value chain: production, consumption, waste management, utilisation of secondary raw materials and fuels, by launching long-term actions under the coordination of a special inter-ministerial body in cooperation with a joint advisory committee consisting of representatives of producers and of the society, thus facilitating consultation with the civil society and the market. Following are key actions to be implemented in the context of the four-year plan:

• Adopting circular and green public procurement, primarily linked to public procurement and services, which will strengthen the demand for secondary materials and boost the national recycling industry.

• Providing financial incentives for businesses investing in environmental technologies.

• Promoting and financing proposals for the reuse of water and sludge from sewage treatment plants.

• Revising the National Waste Management Plan and the respective Regional Waste Management Plans.

• Promoting energy utilisation in accordance with the EU guidelines laid down in the Communication from the Commission COM (2017) 34 final of 26 January 2017.

• Preparing a Circular City Guide, to support local authorities, by utilising related initiatives at international and national levels.

• Elaborating rules and adopting standards for the incorporation of product ecodesign criteria.

• Transposing into the national legislation Directive 2019/904/EU on the reduction of the impact of certain plastic products on the environment and launching actions for eliminating the use of single-use plastic products by 2021, combined with the adoption of incentives for businesses in the sector concerned to adapt to the new situation by modernising their equipment and retraining their employees.

Combating plastic pollution

A key action to be implemented in the context of the EU circular economy guidelines, in particular with regard to combating and mitigating plastic pollution, is transposing into the national legislation Directive 2019/904/EU on the reduction of the impact of certain plastic products on the environment.

On the basis of EU data, single-use plastic products represent a major cause of coastal pollution (single-use plastic products 50%, other plastics 7%, fishing gear 27%), whereas plastic food packages and wrappers, cotton bud sticks and lightweight plastic carrier bags rank high in the top-ten list of such single-use plastic products. On the basis of data from HELMEPA's coast cleaning campaigns, plastic bags, plastic bottles, lids, plastic food packages, straws and cigarette butts were included in the ten most common types of waste collected from Greek coasts in 2017, whereas plastic represented 84% of all the waste collected.

In this respect, priority will be given to transposing into the national legislation Directive 2019/904/EU and then launching actions for putting an end to the use of single-use plastic products by 2021, consisting in the adoption, following dialogue, of legislation for decisively combating plastic-caused coastal pollution and providing incentives for businesses in the sector concerned to adapt to the new situation by modernising their equipment and retraining their employees. In this context, emphasis will be placed on specific programmes to combat plastic pollution, adopt responsible consumption patterns and use alternative, non-plastic single-use products, in cooperation with reputed institutions, NGOs and representatives of the plastics industry.

Greece, taking a responsible and ambitious stance in the combat against plastic pollution with a view to protecting coastal and marine ecosystems and its tourism, as well as improving the quality of life of its people, has committed to complete the elaboration of a relevant draft law, which will be tabled for adoption in June 2020, i.e. one year earlier than the deadline set by the EU (July 2021), and will also take preparatory action to help the private sector and public administration adapt to the new situation.

PP1.8. Urban bioclimatic restructuring and smart cities

Cities can play a major role in developing and implementing climate change policies and measures, as they are a link between local action and national and international commitments for climate change mitigation. Urban and industrialised areas in Greece have a significant share in national energy consumption and GHG emissions. Therefore, improvement in town planning and energy management at a local level contribute decisively to reducing energy consumption in cities as well as the carbon footprint.

Moreover, 'smart and sustainable city' models which are based on increased integration of clean energy technologies, coupled with the use of state-of-the-art ICTs, are one of the main axes of energy sector restructuring. A 'smart' city invests in human and social capital, in traditional and modern ICT infrastructure, thus promoting sustainable economic growth and a high standard of living through prudent management of natural resources and through participatory governance. Using 'intelligent' media at a city level results in improved living conditions for people, by attracting businesses and investment at a local level and increasing the market value of real estate.

Smart meters and smart networks will form a key part of these plans, allowing for the monitoring and management of the large amounts of information that are necessary for their harmonious operation and making a substantial contribution to the rational use of energy by final consumers at a city level. In conjunction with the new regulatory framework for the demand response mechanism and energy communities, it is expected to strengthen significantly the role of cities and people in the transition and ultimately in the restructuring of the energy sector. In addition to that, the use of 'intelligent' applications is also closely related to urban restructuring, aiming primarily to improve the standard of living for residents and the operating conditions for businesses.

Urban bioclimatic restructuring is associated with energy consumption management, use of cold or photocatalytic coating materials in public spaces, water management in public spaces, lighting management in jointly used areas, use of renewable energy sources in the city (in private and public spaces), smart waste management, green rooftops, green walls, low and almost zero-energy buildings, cycling routes, walkways, city squares, traffic and parking management systems, technological applications for providing information in public spaces, as well as environmental awakening of people. Moreover, proper town planning and architectural bioclimatic design and the use of sustainable materials in bioclimatic design (cool materials, shading structures, plants) are essential requirements for the sustainable development of cities.

Individual actions to increase urban greenery, such as the creation of urban green canyons with appropriate tree-planting in roads, urban gaps, free public spaces and squares, protection and promotion of streams and rivers and restructuring of streamside, riverside and lakeside areas, as well as use of modern cold materials and technologies with a high solar reflectance level that lead to energy savings in the built environment, and management of water, wind movement and urban noise are structural components of the sustainable development of cities as they reduce thermal values and the energy and carbon footprint, thus contributing significantly to the mitigation of climate impact and the improvement of the quality of life of people.

In the context of a holistic approach, smart governance systems contribute to streamlining city management processes, promoting effective communication, cooperation and engagement of people and ultimately strengthening decision-making and successful adoption of policies, measures and mechanisms at a local level. The aim is to support the relevant integrated actions through active participation of public and private bodies which are active locally and to integrate these priorities in the urban planning of cities.

The implementation of energy efficiency improvement measures, which have been included in the policy priorities for improving energy efficiency in the building sector and in industry, including electricity and gas infrastructure, contribute to reducing GHG emissions and, therefore, to mitigating climate change impact. Also, heat generation by high efficiency combined heat and power (HECHP) plants and the use of district heating to meet the thermal needs of buildings, as well as the utilisation of discarded heat for energy generation purposes reduce GHG emissions by reducing the consumption of petroleum products and other conventional fuels.

Emphasis will also be placed on tourism given the ever-increasing influx of tourists and the extended tourist season, which tend to increase and change energy needs as well as the environmental and carbon footprint of tourism. A detailed description of all policies and measures for energy transition in tourism are described in section six of this chapter.

PP1.9. Involvement of the financial sector

The involvement of the financial sector (banks, investment firms, social security organisations, etc.) is pivotal in energy transition and in combating climate change impact. Also, incorporating environmental, social and governance (ESG) criteria in investment management practices is becoming more and more important at a global scale, just like the case is with sustainable development issues, for capital management companies and the relevant regulatory authorities.

At a national level, Law 4403/2016, requires large entities of public interest to make publicly available the management report included in their annual financial statements as well as non-financial data, including information on environmental, social and employment issues (ESG), the protection of human and labour rights, their combat against corruption and related policies, the CSR actions they are implementing and eventually the method they are using to create value for their stakeholders. Moreover, through an analysis of the most important sustainable development issues, companies identify, analyse and give an account for issues that are important for their stakeholders but also for sustainable development, thus setting out in their reports their exposure to energy, climate and other non-financial risks. In this context, companies (including financial institutions and all listed companies) are encouraged to adopt specific international standards for the disclosure of non-financial information, including an analysis and integration of climate risks, apart from other risks, in their business models.

To that end, the Athens Stock Exchange issued a 'Guide for the disclosure of ESG information' in 2019, which is a practical tool for companies to identify important issues regarding the environment, society and corporate governance which they have to make publicly available and manage in order to respond successfully to the global trend of investors including such non-financial data. Although the guide is intended mainly for listed companies, it can also be useful for non-listed companies of all sizes and branches of activity, to enhance transparency in sustainable development issues. The implementation of the NECP and the attainment of its more specific energy and climate objectives require the active participation of the financial sector and of the Greek market.

The Greek government is planning and constantly providing incentives for making investment towards the attainment of energy transition and climate objectives. Clearly, however, the magnitude of the investment challenge exceeds the financing capabilities of the public sector. That is why it is crucial to get the financial sector (banks, investment firms, social security organisations, etc.) involved, in order to:

(a) redirect their capital flows to genuinely viable and responsible investment and green technologies, achieving high private and foreign capital leverage in this direction;

(b) effectively manage any financial risks on the markets, resulting from climate change, environmental degradation, social issues and other non-financial factors; and

(c) contribute to the transition to a sustainable low-carbon economy, energy savings and more efficient use of energy resources.

In this light, the government's policy priority is to establish a framework for **green investment assessment and classification** in a way that is uniform and consistent in all economic sectors, which will result in putting in place the appropriate conditions and incentives for further developing **green financing** and financial instruments in the financial sector. In this direction, the Greek financial sector, capital management companies in particular, have signed and adopted the UN global **PRI Initiative (Principles for Responsible Investment),** thus making a commitment to incorporate environmental, social and governance (ESG) criteria in their investment decision making and in property policies and practices, to check investment against the ESG criteria and promote them in the investment industry, to collaborate with other bodies and networks in applying the principles and to present annual reports on applying them.

Also, financial institutions in Greece have adopted (or are in the process of adopting) the UNEP Finance Initiative – Principles for Responsible Banking. Adopting the principles helps harmonise the banking sector with the sustainable development goals (SDGs) and the Paris Agreement on climate, as laid down by the United Nations. By signing the six principles for responsible banking, the banking sector has accepted the commitments thereunder, thus being encouraged to set objectives for addressing its most significant negative impact and increasing its positive impact, to make sure that they are aligned with, and contribute towards the achievement of, national and international environmental objectives.

Also, the Athens Stock Exchange has participated in the UN Sustainable Stock Exchange (SSE) initiative since 2018, promoting the dissemination of best practices for the disclosure of non-financial data, with a view to strengthening sustainable investment on local capital markets.

3.2.2 Financing measures including support from and use of EU funds in this area at a national level

As explained above, a significant part of the funding for the implementation of the measures proposed, especially in the areas of waste, rural development and forestation, comes from EU resources and involves infrastructures and programmes that are either implemented within the current programming period (2014-2020) or will be planned in the following programming period (2021-2027) through the corresponding NSRF and Rural Development Programme.

Special reference is also made to financing development actions in Greek areas whose economy depends strongly on lignite extraction for power generation, in the region of Western Macedonia and the municipality of Megalopolis in particular, to support just transition in these areas through the establishment of a 'Special account for just transition in lignite-producing areas'. The development actions to be financed in each annual cycle of allocation of the revenue from the auctioning of emissions allowances will be determined through an open public consultation on the basis of the following axes:

- Development of clean forms of energy, funded by projects implemented by energy communities with the participation of natural persons, and/or local authorities and/or legal persons governed by private/public law, aiming to promote renewable energy sources and reduce energy poverty. This axis could include, inter alia, biomass/biogas projects, with the participation of local livestock cooperatives and generally autoproduction projects with the possibility of utilising existing energy infrastructure (e.g. distribution and/or transmission networks).
- Preventing energy poverty: Developing natural gas networks for safe energy transition in these areas, conversion of district heating networks.
- Energy savings: Improving the energy performance of public/private buildings in compliance with the minimum energy performance requirements for buildings and tackling energy poverty. Prioritising the promotion of energy communities with the participation of local authorities as eligible entities.

- Supporting the primary sector: Promoting energy crops, namely locally produced biomass for the supply of alternative district heating systems, and enhancing local crops with high added value (e.g. saffron, rose, oregano, tea), new innovative livestock activities, and promoting the export activities of existing cooperatives and their verticalised development. Geothermal field utilisation projects could also be included in this axis to support greenhouse crops and greenhouse parks, as well as circular economy operations including the treatment of sewage sludge and the disposal of products as soil improvers, land reclamation and/or irrigation projects, etc.
- Interventions in the field of circular economy / recovery of secondary materials, by strengthening the market in secondary materials, laying down technical standards for secondary materials, utilising and trading in secondary materials on the market and including them in public projects, aiming to reduce dependence on mineral resources and eventually protecting the environment and climate by reducing the intensity of primary material production activities.
- Treatment and energy utilisation of sewage sludge and disposal of products as soil additives, utilisation of ash, etc. with emphasis on the respective actions/projects/priorities of the National Plan for Circular Economy.
- Industrial heritage: Utilising lignite-fired plants to promote the industrial heritage of the lignite-producing areas in Greece.
- Implementing integrated action programmes in the field of employment (e.g. new forms of energy, agri-food industry, tourism, subsidising new jobs in companies dealing with systems or techniques for managing and saving energy or energy upgrading, etc.), as well as training programmes in the above areas.
- Implementing entrepreneurship and innovation support programmes in various sectors and especially in those mentioned above.
- Providing technical support to potential beneficiaries for the maturation of projects/actions for public works.

The Just Transition Support initiative will continue over the period 2021-2030 through the use of a potential surplus of auctioning revenue, whereas the possibility of using funds from the Special Account to co-finance actions funded primarily from other sources is already being considered. There is also an aim for supporting ‘Just Transition’ through other financial instruments of the period 2021-2027.

3.2.3 Summary of policy measures

Table 15 summarises the policy measures foreseen for reducing GHG emissions.

Table 15: Policy measures foreseen for climate change and GHG emissions and removals.

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M1	**Shutdown of lignite-fired power plants and interconnection of autonomous island systems**	**PP1.1**	Reduction in GHG emissions	Power generation	Regulatory, technical measure
M2	**Promoting natural gas as an intermediate fuel for reducing the carbon footprint of the energy system**	**PP1.1, PP1.9, PP1.10**	Reduction in non-ETS GHG emissions	Power generation All sectors of final energy consumption	Regulatory, technical, economic measure
M3	**Promoting RES, storage systems and fuel production from RES**	**PP1.1, PP1.9**	Reduction in non-ETS GHG emissions	Power generation Heating, cooling Transport sector	Regulatory, technical, economic measure
M4	**Reduction in quantities of biodegradable waste**	**PP1.1, PP1.6, PP1.9**	Reduction in non-ETS GHG emissions	All sectors of final energy consumption	Regulatory, technical, economic measure
M5	**Improvement in energy efficiency of buildings, industry and infrastructures**	**PP1.1, PP1.8, PP1.9, PP1.10**	Reduction in non-ETS GHG emissions	All sectors of final energy consumption	Regulatory, technical, economic measure
M6	**Reduction in emissions in the transport sector**	**PP1.1, PP1.3, PP1.9**	Reduction in non-ETS GHG emissions	Transport sector	Regulatory, economic measure
M7	**Reduction in fluorinated gas emissions**	**PP1.1, PP1.4**	Reduction in non-ETS GHG emissions	Industrial processes, refrigeration, air-conditioning, fire protection systems	Regulatory measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M8	**Reduction in emissions in the agricultural sector**	**PP1.1, PP1.5, PP1.9**	Reduction in non-ETS GHG emissions	Agricultural sector	Regulatory, economic measure
M9	**Sustainable forest management**	**PP1.1, PP1.5**	Reduction in GHG emissions	Forestry sector	Regulatory, economic measure
M10	**Promoting circular economy**	**PP1.1, PP1.7, PP1.9**	Reduction in non-ETS GHG emissions	All sectors of final energy consumption	Regulatory, economic measure
M11	**Emission reduction measures in the tourism sector**	**PP1.1, PP1.4, PP1.9**	Reduction in non-ETS GHG emissions	Tertiary sector, tourism	Regulatory, economic measure
M12	**Developing smart networks and promoting smart and sustainable city models**	**PP1.1, PP1.8, PP1.9**	Reduction in non-ETS GHG emissions	All sectors of final energy consumption	Technical, economic measure
M13	**Urban bioclimatic restructuring**	**PP1.1, PP1.8, PP1.9**	Reduction in non-ETS GHG emissions	Buildings	Regulatory, economic measure
M14	**Developing smart governance systems**	**PP1.1, PP1.9**	Reduction in non-ETS GHG emissions	All sectors of final energy consumption	Technical, economic measure
M15	**Climate change adaptation measures**	**PP1.2, PP1.9**	Climate change adaptation	All sectors of final energy consumption	Regulatory, technical, economic measure

3.3 Renewable energy sources

Attaining the core energy objective for a RES share in gross final energy consumption of at least 35% by 2030, compared to nearly 17% in 2017, requires the development of an integrated framework of policies and measures with a regulatory, economic and technical dimension, to be implemented within a specific timeframe, in order to ensure optimal performance and allow for this energy transition to RES.

Particular importance and emphasis should be given to measures that are highly ambitious in terms of attaining that core energy objective and are necessary to attain a much higher share than that of a reference scenario. More specifically, measures aiming to ensure the penetration of RES in new uses and sectors and the energy coupling of sectors are crucial in order to achieve that share through electrification in final consumption.

Furthermore, although the share of RES in power generation even without new measures and policies is expected to rise, the requirement for even higher shares in this sector, being the cost-optimal option, requires combined new measures of both regulatory and technical nature.

Finally, setting ambitious objectives for electromobility will allow for attaining this ambitious core objective, but this presupposes the development of an integrated framework and a strategic plan, taking into account the estimated response of the automotive industry.

To sup up, the definition of policy measures for the promotion of RES in the period 2021-2030 aims to meet eleven different policy priorities (PP2.1-PP2.11), as shown in Figure 5, covering all sectors in which RES can be developed.

PP2.1: Coverage of domestic electricity consumption mainly from RES

PP2.2: Reform of the licensing and physical planning framework, speeding up and effectiveness of licensing

PP2.3: Participation of RES plants in the electricity market without operating aid

PP2.4: Promoting dispersed RES systems and strengthening the participation of local communities and consumers

PP2.5: Ensuring the viability and liquidity of the operating support scheme for RES power plants

PP2.6: Development and reinforcement of energy networks and optimal integration and operation of RES plants

PP2.7: Statutory obligations for a minimum RES share in covering the energy needs of buildings

PP2.8: Strengthening the use of RES systems for covering thermal and cooling needs

PP2.9: Coupling the energy sectors to ensure maximum utilisation of domestic potential by RES and promoting new technologies

PP2.10: Promoting the use of advanced biofuels in the transport sector

PP2.11: Promoting electromobility

Figure 5: Policy priorities of policy measures for the promotion of RES in the period 2021-2030.

The policy measures that have been specified in the above policy priorities are analysed separately in the following sections.

3.3.1 Policies and measures to achieve the national contribution under the EU-wide binding objective for 2030

Over the following decade, RES will play a major role in the domestic energy mix, whereas in respect of domestic power generation in particular, they are expected to have a share of more than 50% as early as in 2025. While it was necessary to have a support scheme in place for providing operating support to RES plants in the previous period, now there are specific technologies that are mature in commercial terms and their power generation costs are, in a number of cases, more competitive than those of the respective thermal power plants.

Owing to the above reasons, the promotion of RES technologies for power generation with minimum operating aid is a key priority for the following period, as this will lead to the gradual reduction in the charges imposed on consumers for the development and operation of RES plants. More specifically, operating aid for the most economically competitive RES technologies in market terms, such as photovoltaics and wind farms, is expected to keep decreasing and eventually to be discontinued in the mid-term, as plants using these technologies will be fully competitive in terms of the electricity market and their operation will require no aid of any sort.

Achieving and strengthening that competitiveness in terms of power generation costs is based primarily on the functioning of the competitive bidding mechanism that is already in place. The framework of competitive bidding processes is expected to be extended, supported and modified as appropriate in the coming years, taking into account, each time, the specificities of the Greek energy system and the parameters of the reformed licensing framework, increasing investor interest and ensuring fair competition between the interested parties.

Operation of RES plants directly on the electricity market without the need for operating aid

The ongoing rapid decline in weighted power generation costs for more commercially mature and competitive RES technologies, i.e. photovoltaics and wind farms, is expected to continue and be intensified over the following period. The expanded implementation of competitive bidding procedures is also expected to ensure full operational competitiveness for these projects in terms of the electricity market, and therefore it will be possible to develop the relevant plants without the need for operating aid, meaning that they will be able to participate in the electricity market directly, subject to the same obligations as those imposed on other participants therein. Developing appropriate mechanisms to make sure that participation in the electricity market is achieved in the most cost-effective manner for the energy system as a whole is a critical parameter.

The expanded implementation of competitive bidding procedures is also expected to ensure full operational competitiveness for these projects in terms of the electricity market, and therefore it will be possible to develop the relevant plants irrespective of these bidding procedures and without the need for operating aid.

The aim is that most of the competitive RES projects in the following period will not need operating aid in absolute values, while at the same time participating in the electricity market subject to the same obligations as those imposed on other participants therein.

The technological development of RES has proved that RES can be competitive in market terms as early as in the following years. This is confirmed by the fact that projects with a reference price lower than the current system limit value have been selected in recent RES bidding procedures.

Therefore, RES power plants will be implemented gradually without the need for operating aid, participating in the energy market directly. It is also estimated/expected that RES plants will be implemented / put in operation in the context of bilateral and/or forward contracts between producers and suppliers/consumers or and/or aggregators. These contracts will provide a tool for hedging the risk of consumer price increase and will ensure investment security for producers.

RES and electricity market

A key axis for the further development of RES power plants is their obligation to participate in the electricity market and to meet the relevant obligations thereunder. The obligation to participate in the RES electricity market above certain limits is a key policy measure, entirely complementary and related to sliding feed-in premium competitive procedures and contracts and it reflects the business and commercial maturity with which new plants producing electricity from RES should now be treated. The limits concerned are being adjusted already by assessing this commercial maturity, to make sure that these obligations are expanded and cover new plants of even lower installed capacity.

However, a necessary prerequisite for implementing this policy priority is the operation of the new market model, whose planning parameters will allow for optimal participation of RES plants, with due account taken also of the variable generation of such plants, and will take advantage at a regional level of their low variable power generation costs.

New cumulative representation mechanisms are already being developed under these obligations, whereas operation in accordance with the new electricity market model will increase not only the opportunities but also the obligations for the participation of these plants. The aim is to gradually increase this obligation for the new RES projects provided, of course, that they can participate on an equal basis and are not disproportionately burdened. In this context, clear provision will be made for the **direct participation** of RES plants in the electricity market without their obtaining any kind of aid or guaranteed contract.

However, the sliding feed-in premium scheme will continue to be the key tool for supporting RES technologies in power generation as a whole, whereas specific provision will still be made for plants with a low installed capacity to receive fixed price operating support. In this context, a special monitoring mechanism and procedure are already in place aimed at adjusting the reference price of each technology and category of RES plants in respect of projects that have not yet been put into operation, depending on the evolution of the financing costs and of the development and operating costs of such plants.

Innovative and pilot RES projects will continue to be eligible for financial support through operating and investment aid on condition that they have been proved to cause an increase in domestic added value and that they contribute to covering local and/or special energy needs.

The sustainability of the RES aid scheme is now ensured through the orderly and transparent functioning of the Special RES Account, and therefore this mechanism will continue to function in the best way possible by structuring the available input mechanisms, ensuring its sustainability under all circumstances and offering investment security and certainty to investors.

The development of environmental markets through the use of guarantees of origin for RES energy is scheduled for the following period and is expected to function as a complementary market mechanism which will further contribute to the orderly operation of the Special Account. The introduction of guarantees of origin for biogas and hydrogen from various forms of energy and the coupling of guarantees of origin systems for different forms of energy (electricity, fuel gas, thermal and cooling energy) will help increasing the penetration of renewables in final consumption.

RES and licensing framework

Particular emphasis will be placed in the next period on updating, simplifying and operating more efficiently both the licensing and the physical planning framework for RES. The key aim of this process is to ensure the licensing and ultimately the implementation of the required RES plants in order to attain the national objective. In any case, the development of new projects requires balancing and taking due account of business, environmental and social parameters in a fair and transparent manner, which is the key aim of the licensing and physical planning framework that is currently under revision.

The simplification of the licensing procedures for RES plants is one of the top priorities of the Ministry of the Environment and Energy. The aim is to cut down on project implementation times, to accelerate investment in this sector and eventually to strengthen investor confidence and thus attract new investment.

In this context, a committee has already been established comprising officials from the Ministry, executives from operators, the Regulatory Authority for Energy (RAE) and the RES market players. The committee's objective is to propose measures and policies capable of reducing the total time needed to complete the licensing procedure to two years, with certain exceptions, in line with Directive (EU) 2018/2001. The digitisation of licensing procedures and the operation of one or more contact points where investors can obtain information about licensing will contribute to the attainment of the objective.

Timetable for the operation and deliverables of the committee for reforming the institutional framework for RES licensing

The committee has planned to simplify the licensing procedure in 2 stages:

- Stage 1 (end of 2019): Simplifying the procedure for granting a generation authorisation and drawing up the necessary legislation.
- Stage 2 (by April 2020): Simplifying the licensing process after issuance of the generation authorisation (environmental, connection offer, installation authorisation, operating authorisation and drawing up the necessary legislation). The basic architecture of the information system used to support the licensing procedure will be determined at this stage.

Special care will be taken to ensure that the land available for setting up RES plants is allocated in a balanced way. In this context and as regards photovoltaic plants in particular, priority should be given to available land, including forest land and agricultural land. Similarly, as regards wind farms, the reform of the physical planning framework should define specific prohibited areas and redefine the carrying capacity, with due account taken of environmental considerations. The aim is to create a clear-cut framework for the development of RES plants, with no subjective considerations in respect to the siting criteria.

As regards the physical planning framework in particular, the categories of areas in which the installation of RES projects is partly or entirely prohibited or which are suitable for such installation will be made known in advance and in a clear and transparent manner, whereas the conditions for installation will be determined taking into account such criteria as the character, environmental protection, carrying capacity and human activities of each area of installation. The specific requirements associated with the development of a special regulatory (licensing and support scheme) and physical planning framework for offshore wind farms and floating photovoltaics should also be pointed out.

The multidimensional contribution of dispersed RES generation is indisputable, and therefore it is imperative to maintain and expand the autoproduction and net metering schemes that are already in place. However, it is necessary to follow up on and update the relevant regulatory framework as appropriate, in order to take account of technological developments and to ensure the proper functioning of the electricity networks and the cost-effectiveness of the energy system.

In this context, the energy communities scheme is deemed to be an indispensable tool for strengthening the role of local communities and consumers, and therefore the functioning of these schemes will be supported and strengthened by specific tools. Finally, as part of the reform of the electricity market regulatory framework, the necessary adjustments will also be launched to allow for the participation of decentralised energy schemes.

RES and networks

Energy infrastructure plays a key role in the high penetration of RES plants for power generation, and therefore the design and development of new projects by the operators will incorporate the projections for the penetration of new RES plants and will lay down the necessary adjustments and actions to ensure that its implementation is as seamless and efficient as possible for the functioning of the energy system.

A large increase in installed capacity will be required to make possible a higher RES share in the energy mix. Distribution networks will have to be constructed also in a generation-oriented, not just consumer-oriented, manner from now on. The operators of both the transmission systems and of the distribution network should design the networks with due account taken of future RES development, increasing geographical coverage and strengthening and modernising technologically the high and ultra high voltage transmission systems and distribution networks, provided that there is a clear-cut regulatory framework in place which can be used to determine the growth rate of RES, the operator's obligations, the cost recovery method, etc. The networks should, therefore, be developed in a way that ensures maximum RES penetration and minimises potential cuts in energy generation.

In this context, the best technical and cost-effective enhancement and expansion of energy infrastructure in both the transmission system and the distribution network for tackling congestion that prevents further growth of RES plants in specific areas will also be, for the following period, a core measure for the optimal integration of RES in energy networks.

For example, the possibilities of improving the capacity of existing substations (adding transformers) and upgrading them generally should be utilised. Apart from that, new regulatory models for the allocation of charges for new network and system development projects (substations in particular) should be designed, to facilitate the implementation of such projects for connecting small producers. Moreover, the substations already constructed by producers (primarily for connecting wind farms) could be utilised on the basis of the pilot project that is under implementation in order to cover network distribution lines, as this would allow for connecting more RES plants to the network, whereas the regulatory framework would need modernisation in this direction.

To that end, DEDDIE has already prepared preliminary studies in order to identify the required enhancement of the distribution network, in terms of the number of high/medium voltage transformers that will be congested and will, therefore, need enhancement and of the corresponding distribution lines that will exceed the RES feed-in capacity and will, therefore, need enhancement too. The aim of such as study is to develop a methodology for determining the anticipated investment costs, to identify geographically critical areas of intervention in terms of enhancing the distribution network and to take into account the demand for simultaneous incorporation of new RES projects when assessing the enhancement of substations.

In addition, the development of new financing models to speed up the development of these infrastructures will be launched, whereas management complexity and time lags due to external factors will be limited through more effective planning and transparent consultation procedures. In the above context, energy network operators will examine the interventions planned and identify the costs required for both the required infrastructure and the balancing needs for the operation of these plants.

Also, to increase the utilisation of other networks, consideration will be given to the requirement for taking measures to prevent new plants from burdening the electrical characteristics of the networks (e.g. short-circuit level), which should also apply to existing plants undergoing major overhaul of their generating equipment.

With regard to the major overhaul of generating equipment (repower), this will gradually start emerging as a priority, upon completion of the lifecycle of existing plants, as this RES capacity will have to be preserved in the areas concerned, albeit with due account taken of the new environmental conditions, the obligations to participate in the market and the need to enhance the networks.

In the context of the new interconnections between the autonomous systems on the non-interconnected islands and the mainland system, the utilisation of the existing local RES capacity will be optimised, albeit with due account taken of technical, economic and social parameters. Also, the implementation of the interconnections will favour both the attainment of RES penetration objectives and the energy security of the islands.

RES technologies for power generation

Moreover, the development of all forms of RES for power generation should be ensured. As regards main technologies in particular, both wind farms and photovoltaics should be developed in a balanced way, given the distinct generation profile of either type of these power plants, in order to address adequacy issues. In addition to that, RES plants will have to be geographically dispersed in order to address adequacy issues, in addition to ensuring balanced development in terms of covering available areas. To attain that aim, an effort is being made, inter alia, to promote ***photovoltaic systems on rooftops and buildings and small wind turbines,*** which have developmental and social advantages, as well as to promote ***offshore wind farms*** by developing the appropriate licensing framework.

Apart from that, innovative RES technologies or RES technologies that have not been used sufficiently and can contribute to further utilising this domestic potential will be considered and promoted, mainly in the form of pilot applications. Projects for the use of **wave energy**, possibilities for the development of floating photovoltaics and **production of hydrogen from RES** are some of these applications intended for further analysis in this light.

Particular reference should be made to the possibility of ***using RES systems for desalination***. More specifically, upon preparation of the relevant feasibility and cost-benefit studies, an effort will be made to promote the use of small autonomous RES desalination plants to produce drinking water or to cover irrigation needs on the islands and in remote areas in which the electricity network is either non-existent or weak and which are suffering from intense water scarcity. The small autonomous desalination plants will be combined with RES systems, to cover their need for energy. For example, small wind turbines and photovoltaics for power generation can be installed in reverse osmosis plants, while in the case of thermal desalination plants both low-enthalpy geothermal energy and thermal solar systems can be used. Moreover, given the need for stable power in desalination plants, the use of energy storage is required to increase the operating hours of the plant regardless of the availability of the RES systems. In any case, desalination plants will contribute towards strengthening local development, reducing the use of bottled water — which has a high environmental cost also due to the absence of recycling in most of these areas — mitigating the problems of major electricity networks, the seasonality of water needs and reducing GHG emissions due to the reduced functioning of local power plants for as long as these islands are not interconnected with the mainland system.

The use of ***hydroelectric capacity*** is also a priority, being a resource which should be exploited where available. To that end, the aim is to complete and put into operation the large hydroelectric projects currently under construction, to utilise the potential of irrigation / water supply projects and reservoirs, while further developing small hydroelectric projects. The participation of hydroelectric projects, those with reservoirs in particular, in the domestic power mix is deemed to be critical and necessary for achieving the penetration of uncontrollable RES, with a high share in that mix.

Similarly, as regards ***geothermal energy***, given both the new regulatory framework and the investment interest shown recently for exploring and exploiting high temperature geothermal fields, the prospects for the penetration of geothermal energy in the national energy mix are positive both in terms of thermal energy and power generation, whereas no such plants are in operation in Greece yet, despite this being a technologically and commercially mature application at a global scale.

Given that the regulatory framework for the utilisation of geothermal energy was updated recently and that the issuance of the necessary regulatory decisions for its implementation has not been completed yet, it will take a reasonable amount of time to assess the results of its implementation. Therefore, it is evident that the implementation of an effective licensing system is a priority for the development of the national policy in the field of geothermal energy. Similarly, it is extremely important to plan and adopt support measures intended specifically to inform local communities in areas with significant geothermal fields.

Moreover, the development of both centralised and decentralised ***storage units*** is expected to contribute towards the attainment of the goal of optimal integration of RES in electricity networks.

The further penetration of uncontrollable RES is expected to pose new challenges to transmission system and distribution network operators, as regards the functioning of the system, due to the stochastic nature of the generation of these units. In order to avoid extensive cuts in renewable generation while at the same time ensuring uninterrupted supply to consumers, increased system flexibility is required, which further stresses the importance of sources of flexibility, such as storage. Apart from that, the stochasticity of RES production is an additional risk factor for producers that are required to participate in the electricity market and assume balancing obligations.

Storage systems are expected to play an important role in reducing RES cuts in the system as a whole, to address local congestion problems and to ensure more adequate capacity and better system flexibility. Combining RES plants with energy storage systems, i.e. where they share a common connection point (storage system installed behind the meter or at a point in the distribution network downstream the same point of connection with the high voltage system), can mitigate the impact of RES plants on system operation, smoothing out variations in generation, provided that there are no operating problems.

The benefits resulting for system operators include better network stability through the provision of ancillary services (e.g. voltage control, frequency response and power quality), as well as increased network capacity for connecting new RES plants. For producers, the combined use of storage and RES reduces the cuts caused by the inability to feed the energy generated into the system, also allowing for capacity firming by reducing deviations from scheduled generation. Therefore, new prospects are opened up for participation in additional energy markets, such as the balancing market and the long-term capacity compensation scheme, which will increase the profitability and viability of the investment.

Both centralised and decentralised storage units require the development of a comprehensive regulatory and statutory framework for their operation in energy markets and their integration in electricity networks. The regulatory framework should be developed in a way that normalises the integration of storage systems in new or existing RES plants without, however, distorting the compensation paid to these plants. The role of transmission and distribution operators in identifying the requirements and characteristics of the development of storage infrastructures, also subject to the provisions of the relevant EU directive and regulation, is expected to be crucial.

In this context, the necessary regulations/acts are already being prepared, to make possible the optimal use of these tools. Similarly, demand management and response schemes should be implemented. Participation in demand response schemes should gradually cover not only large industrial consumers, but all consumers, whether individually or through aggregators.

In this direction, the coupling of energy sectors to strengthen optimal RES penetration is also a priority as it contributes to the utilisation of excess electricity generated by RES plants with a view to meeting the demand for heating and cooling and load acceptance in transport.

This objective can be attained through the development and implementation of an integrated demand response framework, the construction of storage units, the digitisation of the energy sector, the orderly functioning of energy markets and pilot actions to promote smart cities.

Combined RES and storage

Combining RES plants with energy storage systems, i.e. where they share a common connection point, has very positive results for both the system and RES producers.

This combination opens up new prospects for participation in additional energy markets, such as the balancing market and the long-term capacity compensation scheme, and offers ancillary services such as voltage control, frequency response, etc., as well as increased network capacity for connecting new RES plants. In addition to that, for producers, it reduces the cuts caused by the inability to feed the energy generated into the system and reduces also deviations from scheduled generation, thus maximising the options for participation in the individual energy markets.

Coupling of sectors

The gradual electrification of final consumption areas allows for coupling the energy sectors and achieves a higher share of RES in final energy consumption. More specifically, the coupling of sectors refers to the possibility of linking power generation with different energy sectors, such as power-to-heat, power-to-gas and transport (electromobility).

The coupling of energy sectors allows for additional system flexibility, as it enhances significantly the ability to feed RES power into the system. Combined with storage systems and intelligent energy management systems, the consumption of flexible loads can be postponed in order to maximise the amounts of RES energy that can be fed into the system. The coupling of the electricity and the heating-cooling sectors (power-to-heat) through energy-efficient heat pumps is already an economically interesting approach, and there are also other options for converting electricity to thermal energy and then storing it.

The options for coupling the electricity and gas sectors (power-to-gas) through storage applications that include conversion of electricity into renewable gas, such as hydrogen, are equally important. The gas produced by using RES energy may be fed into the existing gas network and used as fuel for heating in buildings or in transport.

Moreover, an appropriate regulatory framework should enable different sources and different energy operators (hydrogen, biofuels, biomethane) to function on a complementary basis, contributing to most cost-effective and sustainable system functioning. Measures for ensuring the penetration of RES in new uses and sectors, the energy coupling of sectors and the development of relevant pilot and innovative applications are a policy priority in the context of the NECP for the following decade.

RES in final energy consumption sectors

Maximising synergies with the energy efficiency improvement sector is crucial mainly due to the need to implement the plan for installing smart electricity meters by 2030, to support policy measures under this policy priority. Similarly, consideration will be given also to the possibility of feeding **into the natural gas network hydrogen or methane produced from various forms of energy**. In this direction, the sustainability and efficiency of such a scheme will be considered initially through pilot applications and, if deemed positive, appropriate measures and policies will be promoted with a view to expanding the scope of these technological applications.

The development and optimisation of the licensing framework including drawing up the technical specifications is considered to be a necessary prerequisite for implementing projects relating to the construction of RES district heating networks, feeding biogas into the natural gas network and further exploiting available geothermal fields. Please note that, due to the fact that these measures also contribute to the attainment of the energy efficiency improvement objectives, it is necessary to implement them in order to maximise the synergies of the two sectors of interest.

The potential for further RES penetration in buildings remains high and requires adopting specific policy measures for utilising it efficiently. A key tool will be to implement a regulatory framework for the mandatory share of RES in covering the energy needs of the building sector (setting a minimum share rate). In this context, the provisions for nearly zero-energy buildings will contribute to the further penetration of RES applications in the building sector, taking into account technical and economic sustainability criteria, contributing to the attainment of the objectives set in the context of improving energy efficiency in the building sector.

The above provisions of the regulatory framework will be incorporated in the revised Regulation on Energy Efficiency of Buildings, while special emphasis will be placed on the exemplary role which public buildings used by the State must play by laying down limits for a minimum share of RES taking into account economic sustainability and energy benefit criteria.

In addition, efforts will be made to maximise synergies with both the policy for maintaining the autoproduction and net metering scheme and other policy measures in the field of the energy efficiency of public and private buildings.

The use of RES systems for heating and cooling (mainly heat pumps and solar thermal systems) will be strengthened by combining different policy measures.

Moreover, the financing instruments available in the context of the new programming period and of the respective operational programmes will be designed in a way that contributes towards promoting the most cost-effective RES systems per final consumer category, also taking into account the contribution towards the attainment of the relevant objective. In addition to the financing instruments, provision has also been made for developing a scheme of special tax incentives for the installation of RES systems for heating and cooling in the domestic and tertiary sectors.

To further promote bioenergy, specialised support programmes will be designed both for the development of efficient supply chains for residual biomass / biodegradable matter and for the support and implementation of optimal environmental and energy-efficient bioenergy applications.

RES in transport, promoting electromobility

The most basic and most effective policy measure to promote the use of biofuels in transport is to keep in place the existing regulatory framework for the obligation to blend biofuels and use biofuels individually. More specifically, the obligation to blend diesel with bioethanol at a rate of 7% by volume, as well gasoline with bioethanol at a rate of 1% for 2019 and 3.3% for 2020 of the energy content of gasoline is already in force, whereas both new enhanced blending obligations and the likely extension of the measure to cover other transport sectors too will be examined gradually. Moreover, the need for developing specific market mechanisms to support the use of biofuels in specific sectors will be explored. Finally, domestic production of advanced biofuels will be supported as appropriate, through the development of a support scheme and/or specific financing tools, focusing on the production of biofuels with the highest domestic added value.

The planning of pilot actions for the production and utilisation of RES gaseous fuels in the transport sector will contribute both to reducing implementation costs and improving the technical feasibility of the specific fuels, providing the opportunity for using them more broadly at a later stage. To attain this objective, it is necessary in a number of cases to adopt the necessary regulatory framework for the production of these fuels, for example producing biomethane from organic waste and feeding it into the natural gas network or using it as fuel in vehicles. It is also necessary to lay down the environmental licensing procedure for biogas upgrading technologies, to allow for smoothly implementing the necessary investments.

Given the present environmental and economic challenges, moving towards a low-carbon circular economy is a must for any country wishing to meet the challenges of the modern global economic system. For this move to be successful, however, it has to be planned responsibly and rationally. In the transition to a competitive and sustainable economy, the key axis of this strategy is to consolidate low-emission mobility, in line with our commitment under the Paris Agreement on climate change and in accordance with the 2030 Agenda for Sustainable Development.

The transport sector is a highly energy-intensive sector, as it accounts for 25% of GHG emissions in Europe, thus having a significant environmental fingerprint. That is why the transport sector poses the strongest challenge and provides the most fertile ground for the first application of innovative and environmentally friendly technologies, and for the development of actions which will benefit both the economy and the environment, such as electromobility.

Given that road transport accounts for the largest percentage of GHG emissions in the transport sector and for much of the air pollution, a cohesive and holistic approach and a streamlined and rational strategy are needed to ensure that the transition to a climate neutral economy will be implemented in a way that combines and serves different purposes, including, but not limited to, attracting investment, creating new business opportunities, promoting research and innovation and optimising the transport system through the development of appropriate infrastructure for alternative fuels.

The catalytic role of zero and low emission vehicles (ZLEVs) in this transition is indisputable, as described above.

Moreover, CO_2 emissions ceilings were laid down for vehicle manufacturers in respect of new passenger vehicle registrations per year, in accordance with Table 16.

Table 16: Average CO_2 emissions ceilings for passenger car registrations.

2020	Maximum average CO_2 emissions 95 gr/km
2021	Reduction of average CO_2 emissions to below 95 gr/km
2025	Reduction by 15% compared to 2021
2030	Reduction by 37.5% compared to 2021

The application of the new and more rigorous method for measuring CO_2emissions, as referred to above, and the more stringent emission rules will require vehicle manufacturers to develop and place on the market low-emission vehicles, and therefore numerous new electric models are expected to become available in the following years, starting from 2020.

It should be stressed that the increasing share of RES technologies and the decreasing share of fossil fuels in power generation will make the role of these vehicles more and more important. This is so because electric vehicles will provide an increasingly 'cleaner' mode of transport compared to conventional vehicles, insofar as the carbon footprint of power generation keeps dropping.

Therefore, the **promotion of electromobility is a key policy objective**, which will be contingent upon the completion of the relevant regulatory framework and upon making plans for the development of necessary energy infrastructures for recharging electric vehicles.

This also includes measures for electric micro-mobility vehicles, which can replace part of the transport operations carried out with vehicles, provided that appropriate infrastructures are built.

To that end, the Inter-Ministerial Committee for the implementation of the project 'Promoting electromobility in Greece' was established and entrusted, inter alia, with the drafting of a ***national operational plan for the development of electromobility, the management and coordination of all actions and operations for promoting electromobility at an inter-ministerial level, the planning and implementation of an integrated package of incentives and the definition of the physical planning and setup of the regulatory framework for electric charging infrastructures.***

Despite its small size, the Greek vehicle market is marked with distinct specificities compared to the markets of other Member States primarily due to the significant recession of the Greek market in new passenger vehicles in the period 2010-2018. This is due, firstly, to the heavy taxation imposed on vehicles and, secondly, to the prolonged economic crisis of the last 10 years, which has rendered the market unstable and vulnerable.

For example, please note that the average size of the market in new passenger vehicles in the period 2010-2018 stood at 85 890 vehicles, which represents a drop of over 68% compared to its average size in the 2000-2009 period. Please note also that the above sales are broken down into 47 444 vehicles placed on the retail market (55.2% share) and 38 444 vehicles placed on the corporate market (44.8% share).

With regard to what Greek consumers can afford, most passenger vehicles registered in 2018 fell under segments A, B and C [14](all three segments having a total aggregate share of 94.6% in 2018, and each one of segments A, B, and C having a share of 16.1%, 45.5% and 31.1% respectively). It should be pointed out that the average financial capacity of the market is EUR 15 000 - EUR 25 000 € per vehicle placed on the market.

The Greek fleet consisted of an estimated 5.15 million vehicles at the end of 2018, with an anticipated increase of 920 000 vehicles by 2030, provided that there is some kind of input-output inventory in place. It should be stressed that it is currently the ***4 th oldest fleet in Europe, as over 56% of the vehicles are 10-20 years old and 25% of them are older than 20 years.***

As regards the penetration of electric vehicles in the Greek vehicle market, battery electric vehicles (BEVs) and plug-in hybrid vehicles (PHEVs) **did not exceed 0.33% of the overall market in August 2019**.

In view of the above statistics, the setup of the Greek fleet and the average financial capacity of consumers do not favour the penetration of electromobility given the operating conditions of the existing market. It is, therefore, necessary to draw up an efficient package of measures and policies to facilitate the increase in the number of electric vehicles.

We can also see why State regulatory intervention is needed if we take a look at the examples of other European countries in which the market in electric vehicles has reached a remarkable size and in which strategies to promote electromobility are being implemented. Such examples include the United Kingdom, the Netherlands, Norway and Sweden. Significant incentives are offered in these countries that make the market in electric vehicles and the charging of such vehicles more attractive, thus resulting in rapid growth of electromobility.

A detailed description of the strategies and incentives implemented in various countries is given in the relevant section of Annex A, which deals with existing measures and policies in other countries, as these can serve as a point of reference and a basis for benchmarking for the measures and policies which can be implemented in the domestic vehicle market.

[14] **A segment**: micro city cars, **B segment**: small cars, **C segment:** medium cars

The national policy for promoting electromobility is drawn up and further specified in five different directions:

1. Expanding the ‘purchase base’ of the Greek market by modifying consumer identity (profile).
2. Replacing older vehicles with ‘clean’ BEVs and PHEVs.
3. Increasing the existing 0.33% share of electric vehicles in the Greek market to at least 8.7% of new registrations in 5 years (2020-2024).
4. Developing a new ‘user environment in terms of infrastructure and benefits (incentives).
5. Providing the general public with information by organising communication programmes.

An integrated package of incentives should be introduced to facilitate a smooth transition towards zero-emission mobility. Also, a specific transitional measure should be put in place to enable access to zero- and low-emission vehicles to consumers, as Greece is one of the Member States with low levels of market penetration of such vehicles[15].

As explained above, a number of incentives are offered in many European countries, with a view to developing the market in electric vehicles. For example, Annex A lists certain best practices applied in these countries, a combination of which could be applied in Greece too.

These incentives are broken down into (a) purely financial incentives (market price subsidy, reduced registration and use costs through tax exemptions, special pricing policy in insurance schemes, reduced tolls, reduced coastal shipping fares for electric vehicles, etc.), and (b) use-related incentives (entry to and daily use in major cities, free parking in municipalities having controlled parking systems in place, supporting the setup of energy supply networks for vehicle recharging, etc.).

The above incentives are further broken down into those intended for private vehicles, commercial vehicles, taxis or State vehicles.

[15] Recital 20 of the preamble to Regulation (EU) 2019/631

The draft law concerning a tax reform with a developmental dimension for tomorrow's Greece, which has been put to public consultation, introduces a package of measures for promoting the use of passenger electric vehicles and zero- or low-emission mass transport vehicles.

Initially, incentives are granted to companies in order to purchase or lease vehicles featuring anti-pollution technology and make them available to their employees. More specifically:

- The gross revenue of an enterprise that leases a vehicle with zero or low emissions up to 50 gr/km CO_2 is reduced by an additional of 30% of the value of that vehicle if its retail price does not exceed EUR 40 000 ('over-depreciation' in lease fees).
- Provision is made for an increased depreciation rate of 25% (depreciation in 4 years) and 20% (depreciation in 5 years) per tax year for purchasing passenger electric vehicles (for up to 9 passengers) with zero or low emissions up to 50 gr/km CO $_2$, respectively.
- Provision is made for an increased depreciation rate of 25% (depreciation in 4 years) and 20% (depreciation in 5 years) per tax year for purchasing passenger electric vehicles (for up to 9 passengers) with zero or low emissions up to 50 gr/km CO_2, respectively.
- Provision is made for an increased depreciation rate of 20% and 15% per tax year for purchasing freight vehicles with zero or low emissions up to 50 gr/km CO_2, respectively.
- In the case of employees, partners or shareholders of enterprises, or their relations, the market value of a vehicle with zero or low emissions up to 50 gr/km CO_2 and with a retail price before tax of EUR 40 000 is deducted from his/her income from employment and pensions, which currently represents additional taxable income.
- To promote the deployment of publicly accessible electric vehicle charging infrastructures, an enterprise is granted a 30% deduction in its gross revenue for the purchase, installation and operation of charging points.

Two different scenarios were prepared for assessing the penetration of electromobility in the Greek market:

- ✓ **Scenario A (reference scenario):** In accordance with the scenario for the evolution of the annual number of registrations and based on market estimates, electric vehicles will represent 24.1% of new registrations in 2030.
- ✓ **Scenario B (frontloaded scenario with economic growth and increased policy measures):** In accordance with the scenario for the evolution of the annual number of registrations and with a view to attaining the ambitious objective with economic growth

and increased policy measures by 2030, electric vehicles will represent 30% of new registrations in 2030.

The data used to determine the evolution of the share of electric passenger vehicles in the annual number of new registrations on the Greek market are shown in Table 17, and the estimated annual evolution in the period 2018-2030 is shown in Chart 6.

Table 17: Data used to determine the evolution of the share of electric passenger vehicles.

Scenario	Year	New passenger vehicles purchased	Overall market change	Overall market increase	Passenger BEVs-PHEVs	Annual increase	Percentage of BEVs-PHEVs in annual market
Scenario A (reference scenario)	2018	103,431	-	-	315	-	**0,3%**
	2019	115,000	11,569	11 %	461	146	**0.4 %**
	2020	127,400	12,400	11 %	1,151	690	**0.9 %**
	2021	137,635	10,235	8 %	3,450	2,299	**2.5%**
	2022	148,646	11,011	8 %	6,900	3,450	**4,6%**
	2023	160,538	11,892	8 %	10,349	3,449	**6,4%**
	2024	173,381	12,843	8 %	15,005	4,656	**8.7%**
	2025	187,251	13,870	8 %	20,257	5,252	**10,8%**
	2026	202,231	14,980	8 %	26,333	6,076	**13.0 %**
	2027	218,410	16,179	8 %	33,180	6,847	**15,2%**
	2028	235,883	17,473	8 %	41,806	8,626	**17.7 %**
	2029	254,753	18,870	8 %	52,676	10,870	**20,7%**
	2030	275,133	20,380	8 %	66,371	13,695	**24,1%**
Scenario B (frontloaded scenario with economic growth and increased policy measures)	2018	103,431	-	-	315	-	**0,3%**
	2019	115,000	11,569	11 %	461	145	**0.4 %**
	2020	127,400	12,400	11 %	1,265	805	**1,0%**
	2021	137,635	10,195	8 %	3,795	2,530	**2.8 %**
	2022	148,646	11,011	8 %	7,589	3,794	**5,1%**
	2023	160,538	11,892	8 %	11,797	4,208	**7.3%**
	2024	173,381	12,843	8 %	17,436	5,639	**10.1%**
	2025	187,251	13,870	8 %	24,036	6,600	**12,8%**
	2026	202,231	14,980	8 %	31,246	7,210	**15,5%**
	2027	218,410	16,179	8 %	40,093	8,847	**18,4%**
	2028	235,883	17,473	8 %	51,458	11,365	**21,8%**
	2029	254,753	18,870	8 %	66,059	14,601	**25.9 %**
	2030	275,133	20,380	8 %	82,422	16,363	**30.0 %**

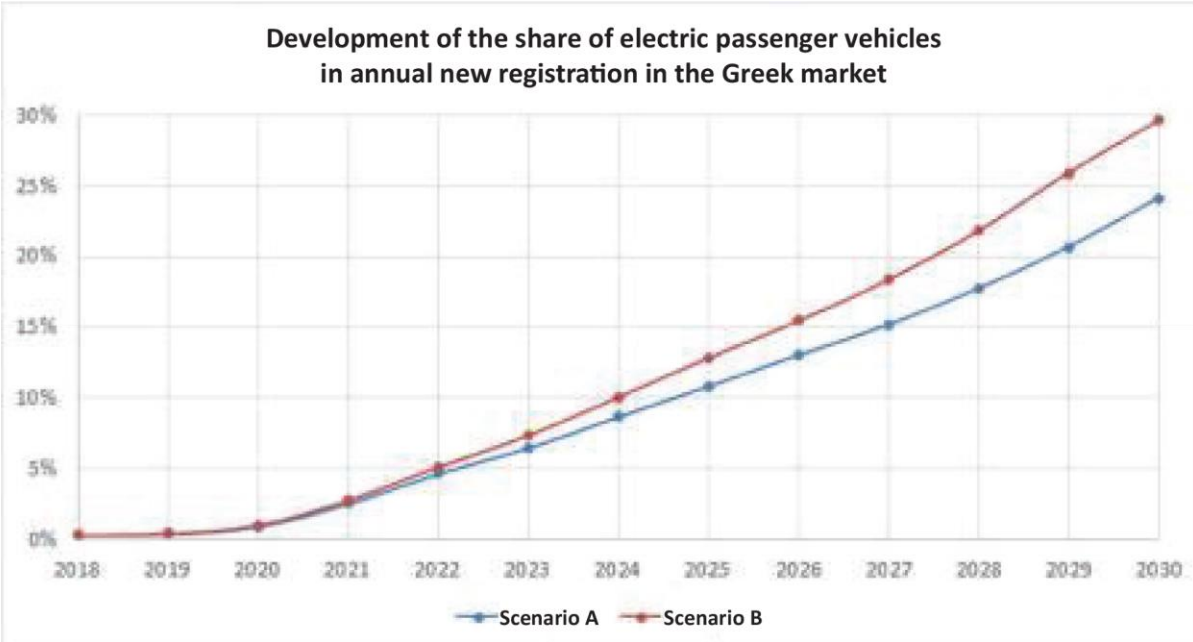


Chart 6: Evolution of the share of electric passenger vehicles in the annual number of new registrations on the Greek market.

On the basis of the above forecasts, the NECP has set a target of 30% for the share of electric passenger vehicles in the number of new registrations in 2030.

RES and competitiveness

Total new investments in RES power generation in the following decade are expected to deliver a **return in terms of domestic added value of over EUR 12 billion** during their operation. **throughout the operation of such systems.** Similarly, there are many benefits to creating direct and indirect jobs thanks to the deployment and operation of these projects, as an estimated over **37 thousand new full-time jobs** will be created and maintained in the following 25 years.

3.3.2 Special measures for regional cooperation, as well as the estimated surplus energy generation from renewable sources

Cooperation with neighbouring Member States is envisaged so that RES and HECHP power plants located in countries within the European Economic Area can take part in the tendering procedures, provided that there is active cross-border energy trade with them. The aim is to enter into a reciprocity pact with these candidate countries laying down the terms and conditions and clarifying all other relevant issues that will allow the bidirectional participation of candidate RES and HECHP projects in specific tendering procedures that will take place in Greece and in the other Member State in the immediate period ahead. The amount of electricity generated by these projects, which may be selected in the context of these tendering procedures, will result from the application of a specific methodology already described and defined in a regulatory act.

At present, no provision has been made concerning the use of other cooperation mechanisms either for surplus electricity from renewable energy sources to be transferred to other Member States or for electricity deficiency in order to achieve the national contribution and the pathways presented in relation to the share of RES in gross final energy consumption.

In terms of regional cooperation in the context of the TARES project, there is cooperation with the corresponding ministry of the German government for promoting RES in all sectors through the development of measures and market mechanisms.

Moreover, as referred to in the section on regional cooperation in planning, Greece's participation through its representatives in CA-RES contributes significantly to cooperation between Greece and other Member States.

3.3.3 Special measures relating to financial support, including support through, and use of, EU funds

The key financial instruments include:

- Domestic and international financial resources
- Special RES Account with specific sources of financial revenue for the operating support of electricity generated by RES
- National operational programmes in the context of the new programming period
- New investment law
- Resources from national and EU research programmes, as well as resources for the implementation of innovative and pilot applications in the context of international collaborations

3.3.4 Assessment of support for electricity from renewable sources to be carried out by Member States

The proper functioning of the Special RES Account is largely related to ensuring the sustainability of the RES support scheme. This has now been achieved through successive legislation adopted in recent years, to ensure both sufficient and steady inflows of financial resources and to streamline the inclusion of specific revenue categories in it.

The transparent functioning of the Special RES Account is also ensured by the monthly record of the detailed and segregated by category and/or technology financial inflows and outflows required for the function performed by the competent body (RES and Guarantees of Origin Operator - DAPEEP), which is posted in the form of a monthly bulletin on a specific publicly accessible webpage (online link).

As part of the monitoring of the operation of the special account, forecasts of future inflows and outflows are made for at least the following calendar year in order to establish whether there is need to take measures for its optimal operation and financial liquidity. It should be noted that, specific legislation has been adopted (Law 4533/2018) providing for a special security reserve of EUR 70 million (70 000 000) for extraordinary expenses, which should be taken into account in planning the course of financial inflows and outflows of the special account, respectively.

Therefore, in the following period, this mechanism will continue to function optimally with regard to the structure of available inflow mechanisms, ensuring in any case the necessary support of RES electricity for the respective plants in operation.

3.3.5 Specific measures for setting up one or more contact points, simplifying administrative procedures, providing information and training, and facilitating the conclusion of electricity purchase agreements

As already mentioned, a key priority for the following period is the updating, simplification and more efficient functioning of both the licensing and physical planning framework for RES. In this context, existing information tools and databases will be improved and new ones will be deployed to allow for optimal provision of related information to the interested parties. The aim is to implement the licensing framework for RES power generation, to observe specific timeframes for the evaluation and issuance of licensing acts, as well as to codify the relevant legislation so that uniform and complete information is provided both to the licensing authorities and the interested parties. In this context, in addition to updating the overall licensing framework, which will take into account the new requirements and possibilities for the operation of these projects, the establishment of one or more central contact points will be promoted, aimed at facilitating both the licensing and eventually the deployment and implementation of the RES plants required to attain the national objective.

In respect of dispersed generation by RES systems, as already described in a previous section, there are autoproduction, net metering and virtual net metering schemes in place, with specific technical characteristics, criteria and administrative requirements for including users therein. These schemes also incorporate a specific methodology for the settlement of the electricity generated by decentralised RES power generation systems. The regulatory framework for the operation of these schemes is being updated to take account of technological developments and to allow the use of electricity storage systems, whereas the aim for the future is that these schemes should be modified and adapted accordingly to ensure the smooth functioning of the electricity networks and the cost-effectiveness of the energy system, while at the same time enabling consumers to choose to install and use these systems without facing disproportionate technical or financial obstacles.

The development of a specific institutional framework for the promotion of energy communities, which has already been completed and is in place, is deemed to be a necessary tool for strengthening the role of local communities and consumers, and therefore the operation of these schemes will be supported by the use of licensing and operational incentives (e.g. with regard to limits for participation in tendering procedures and possibilities for representation on the electricity market). Moreover, considerable participation of energy communities in net metering schemes (virtual net metering in particular) is expected, thus maximising the benefits resulting for the local economy.

3.3.6 Assessment of the need to build new RES district heating and cooling infrastructures

RES potential for the development of district heating applications has been identified on the basis of technical and financial criteria in specific areas of Greece and concerns primarily the exploitation of low-enthalpy geothermal fields, as well as residual solid biomass. In this context, specific feasibility studies have already been developed for the deployment of district heating networks, which in most cases take into account the use of these infrastructures to cover local needs in the domestic, tertiary and rural sectors.

The interest in such infrastructure focuses mainly on Northern Greece and/or semi-mountainous / mountainous areas, as well as on certain North Aegean islands where there is both local RES potential for district heating and inter-seasonal thermal needs at a local level. Just as important is the interest in using the existing district heating infrastructures, after lignite is replaced as fuel, and utilising locally available RES, biomass in particular, whereas natural gas can be used on a transitional/complementary basis.

The deployment of such infrastructure will — insofar as the financial viability of the investment is ensured in terms of the number of users, the amount of thermal energy consumed and the length of the network under deployment — yield significant benefits in terms of local added value and the protection of final consumers with respect to energy costs.

The objective is to deploy, also through the use of financial instruments providing support from national co-financed projects, RES district heating networks using solid biomass and geothermal energy of 30-40 MW_{th} over the following period.

3.3.7 Specific measures to promote the use of energy from biomass

The use of biomass for energy generation and/or fuel production in Greece is limited in relation to the availability of residual biomass. It should be used with due account taken of the characteristics of domestic agricultural activities, the competitiveness of its uses and the possibilities of developing supply chains. At the same time, appropriate energy infrastructures should be deployed for using it, depending on the type of use. Focus will be given in the following period on the transition from current conventional energy uses of biomass to more energy-efficient and cost-effective applications over the entire spectrum of the Greek economy, with emphasis placed on sustainability criteria and sustainable management. Flagship policies which are being planned currently consist in promoting advanced biofuels and utilising the production of biomethane by feeding it directly into the natural gas network. With regard to the promotion of the use of biomass-derived energy, the relevant thematic section on the agricultural sector proposes specific measures for meeting the political priorities concerned.

3.3.8 Summary of policy measures

Table 18 summarises the policy measures planned for the promotion of RES.

Table 18: Policy measures planned for the promotion of RES.

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M1	**Competitive procedures for commercially mature RES technologies.**	**PP2.1, PP2.2, PP2.5, PP2.6**	Increase in RES power generation	Power generation	Regulatory, economic measure
M2	**Obligations to participate in the market and gradual increase of obligations by type of RES plant and of contract models.**	**PP2.1, PP2.2, PP2.3, PP2.5, PP2.6**	Increase in RES power generation	Power generation	Regulatory measure
M3	**Continuation of support scheme with dynamic adjustment of operating support for new installations of individual RES technologies.**	**PP2.1, PP2.4, PP2.5, PP2.6**	Increase in RES power generation	Power generation	Regulatory measure
M4	**Support to innovative pilot projects with high domestic added value.**	**PP2.1, PP2.6**	Increase in RES power generation	Power generation	Economic measure
M5	**Guaranteed liquidity of operating support mechanism for RES plants with optimal structure of inflow mechanism.**	**PP2.1, PP2.5**	Increase in RES power generation	Power generation	Regulatory, economic measure
M6	**Use of guarantees of origin.**	**PP2.3, PP2.5**	Increase in RES power generation Increase in RES for heating-cooling Increase in RES for transport	Power generation, heating-cooling, transport sector	Regulatory, economic measure
M7	**Updating, simplification and optimisation of the functioning of the licensing framework.**	**PP2.1, PP2.2, PP2.3, PP2.4, PP2.6**	Increase in RES power generation	Power generation	Regulatory measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M8	**Updating, simplification and optimisation of the functioning of the physical planning framework.**	**PP2.1, PP2.2, PP2.3, PP2.4, PP2.6**	Increase in RES power generation	Power generation	Regulatory measure
M9	**Licensing and physical planning framework for offshore wind farms**	**PP2.1, PP2.2, PP2.3, PP2.4, PP2.6, PP2.9**	Increase in RES power generation	Power generation	Regulatory measure
M10	**Regulatory and statutory framework for storage facilities**	**PP2.1, PP2.2, PP2.3, PP2.4, PP2.6, PP2.7, PP2.9**	Increase in RES power generation	Power generation	Regulatory measure
M11	**Maintenance of autoproduction and net metering scheme, and control and updating of the regulatory framework for its operation where necessary.**	**PP2.1, PP2.3, PP2.6, PP2.7, PP2.9**	Increase in RES power generation Increase in RES for heating-cooling	Power generation, heating-cooling	Regulatory measure
M12	**Support for the deployment of RES energy projects by energy communities also through the use of specialised financing tools.**	**PP2.1, PP2.4**	Increase in RES power generation Increase in RES for heating-cooling	Power generation, heating-cooling	Regulatory measure
M13	**Reform of the electricity market regulatory framework as regards opportunities for the participation of decentralised energy schemes.**	**PP2.1, PP2.3, PP2.4, PP2.6**	Increase in RES power generation Increase in RES for heating-cooling	Power generation, heating-cooling	Regulatory measure
M14	**Aid for energy infrastructures to deal with congestion (in transmission and distribution) and development of new financing models to speed up deployment of such infrastructures. Provision for optimal utilisation of RES capacity**	**PP2.1, PP2.2, PP2.6, PP2.9**	Increase in RES power generation	Power generation	Technical measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
	in the context of new interconnections.				
M15	**Development of demand management schemes.**	**PP2.4, PP2.6, PP2.7, PP2.9**	Increase in RES power generation	Power generation	Regulatory measure
M16	**Development and optimisation of licensing framework and of technical specifications for RES district heating networks, feeding of biogas into the natural gas network, exploitation of geothermal fields (correlation with the measures referred to in the section on waste management).**	**PP2.7, PP2.8, PP2.9**	Increase in RES power generation Increase in RES for heating-cooling	Power generation, heating-cooling	Regulatory measure
M17	**New Regulation on Energy Efficiency of Buildings (correlation with measure M2.1 and the measures referred to in the section on waste management).**	**PP2.7, PP2.4, PP2.8, PP2.9**	Increase in RES power generation Increase in RES for heating-cooling	Power generation, heating-cooling	Regulatory measure
M18	**Public buildings (correlation with measure M2.1 and the measures referred to in the section on waste management).**	**PP2.4, PP2.7, PP2.8, PP2.9**	Increase in RES power generation Increase in RES for heating-cooling	Power generation, heating-cooling	Regulatory measure
M19	**Financing instruments in the context of the new programming period.**	**PP2.4, PP2.6, PP2.8, PP2.9, PP2.10, PP2.11**	Increase in RES for heating-cooling	Heating, cooling	Economic measure
M20	**Application of obligations to energy suppliers.**	**PP2.4, PP2.7, PP2.8, PP2.9, PP2.10, PP2.11**	Increase in RES for heating-cooling	Heating, cooling	Regulatory measure
M21	**Use of tax incentives for installations in the residential and tertiary sectors.**	**PP2.4, PP2.7, PP2.8, PP2.9**	Increase in RES for heating-cooling	Heating, cooling	Fiscal measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M22	**Development of a regulatory framework for the production of thermal energy from RES and the feeding of biomethane into the natural gas network.**	**PP2.9, PP2.7**	Increase in RES for heating-cooling	Heating, cooling	Regulatory, economic measure
M23	**Development of supply chains for residual biomass/biodegradable matter and support for the development and implementation of optimal environmental and energy-efficient bioenergy applications.**	**PP2.10, PP2.9**	Increase in RES for heating-cooling	Heating, cooling	Regulatory, technical measure
M24	**Utilisation of RES power generation for heating/cooling and transport as well as for the operation of storage systems.**	**PP2.9, PP2.11**	Increase in RES power generation Increase in RES for heating-cooling Increase in RES for transport	Power generation, heating-cooling, transport sector	Regulatory, economic measure
M25	**Completion of the necessary energy infrastructures for recharging electric vehicles.**	**PP2.6, PP2.11, PP2.7**	Increase in RES for transport	Transport sector	Regulatory measure
M26	**Development of a framework of incentives for the use of electric vehicles.**	**PP2.11, PP2.6, PP2.1**	Increase in RES for transport	Transport sector	Regulatory, economic measure
M27	**Pilot actions for the use of RES gaseous fuels in the transport sector.**	**PP2.9, PP2.10**	Increase in RES for transport	Transport sector	Regulatory, technical measure

3.4 Improvement in energy efficiency

The definition of policy measures for energy efficiency improvement in the period 2021-2030 aims to cover twelve different policy priorities (PP3.1-PP3.12), as presented in Figure 6.

PP3.1: Improvement in energy efficiency of public buildings and exemplary role of public sector - Improvement of urban public space microclimate

PP3.2: Strategy for renovation of the building stock in the residential and tertiary sector

PP3.3: Promoting energy efficiency contracts by energy service companies

PP3.4: Promoting market mechanisms

PP3.5: Promoting innovative financial instruments to ensure private capital leverage and financial sector involvement

PP3.6: Improvement in energy efficiency and competitiveness of the industrial sector

PP3.7: Framework for the replacement of polluting passenger vehicles and goods vehicles

PP3.8: Developing infrastructure and plans for a shift in transport operations

PP3.9: Energy efficiency improvement of electricity and gas infrastructures

PP3.10: Promoting measures for modernising water supply / sewage and irrigation infrastructures

PP3.11: Promoting efficient heating and cooling

PP3.12: Training/informing professionals and consumers on energy-efficient equipment and rational use of energy

Figure 6: Policy priorities to promote energy efficiency over the period 2021-2030.

The policy measures that have been specified in the above policy priorities are analysed separately in the following sections.

3.4.1 Energy efficiency obligation schemes and alternative policy measures

The objective under Article 7 of Directive 2012/27/EU will be attained by combining the energy efficiency obligation scheme and implementing alternative policy measures. The **energy efficiency obligation scheme** applicable to energy providers will continue to be implemented and its functioning through a new regulatory framework will adjust the energy savings target assumed by the parties involved by taking into account the achievable technical-financial potential for energy savings and will improve both the functioning and efficiency of the scheme. Moreover, the implementation of this scheme will be extended to cover also the distribution network operators for both electricity and natural gas, setting a specific energy efficiency improvement objective and at the same time ensuring that it will not distort competition for the energy providers of the respective energy products. The setting of the objective to be allocated to the schemes in the new period depends directly on the type of measures that will be eligible. The setting of the objective to be allocated to the schemes in the new period depends directly on the type of measures that will be eligible.

Energy efficiency obligation schemes

Energy efficiency obligation schemes are the most widespread market mechanism that leads to optimal implementation of energy efficiency improvement measures in terms of costs and results.

Obligation schemes will make a significant contribution towards attaining the objective under Article

7 in the period 2021-2030 by aiming to promote specific energy savings interventions in order to minimise the burden imposed on obliged parties. Obligation schemes will account for a minimum of 20% of the total cumulative energy savings target, while both energy providers and distribution network operators will participate in the scheme.

The target will be allocated to obliged parties by taking into account the achievable technical-financial potential for energy savings in the obliged parties' areas of activity and the mix of alternative policy measures to be planned.

A significant contribution towards the attainment/fulfilment of the target can be made by the use of dedicated innovative digital modelling as an incentive for the overall lifecycle of a building, from its design/construction to its mode of operation and its adaptation to the ever-changing needs of the enterprises and organisations using it.

The contribution of alternative policy measures to the attainment of this target will be significantly greater, and the process for further specifying these measures is under way. It should be noted that alternative policy measures, which represent the majority of policy measures, are outlined in the following sections.

3.4.2 Long-term strategy for the renovation of the national building stock

In order to mobilise the required investments, a specific package of policy measures is envisaged to improve the energy efficiency of public and private buildings, through the long-term strategy for the renovation of the building stock or the renewal of end-of-lifecycle buildings along with recycling of the construction and demolition waste produced, which is expected to be completed in March 2020, in accordance with the requirements of Directive (EU) 2018/844. The long-term strategy for the renovation of the building stock aims to ensure the technical-financial analysis and determination of optimally efficient measures for attaining the high renovation rate set for the building stock.

In particular, the financing programmes **for the renovation of both residential and tertiary sector buildings** in the context of the new programming period will be implemented by adjusting and improving the existing financing model, with a view an increase in the existing leverage levels by beneficiaries. These programmes aim to:

- increase the number of potential beneficiaries;
- simplify the certification of interventions, using unit cost data;
- ensure more active involvement of domestic financial institutions in the financing of necessary interventions; and
- promote innovation in the domestic construction and manufacturing industry.

In the new programming period, successful financing programmes for improving the energy efficiency of residential buildings will continue, and their operating framework will be duly modified by streamlining the incentives for maximising energy benefits, while at the same time supporting households which are vulnerable in terms of finances and energy.

In the case of **public buildings**, the redrafting of the financing model for energy upgrading actions has been completed, while in the case of other tertiary sector buildings focus will be given to adopting new smart technologies and an effort will be made to achieve an optimal cost-benefit ratio and ensure equal access for all interested parties. Meanwhile, alternative financing mechanisms, such as energy performance contracts, will be adopted.

Upgrading the role of energy managers of public buildings is expected to make a significant contribution, as a relevant clause will be added in financing programmes for the energy upgrading of public buildings. The electronic platform for monitoring the energy behaviour of buildings, which has been completed, aims to assist energy managers in carrying out their functions. The revision of the relevant regulatory framework aims to upgrade their role, in order to ensure the rational use of energy. Continued improvement of the energy efficiency of public buildings will also be strengthened through the implementation of the Action Plans for Sustainable Energy and the Action Plans for Energy Efficiency of Buildings, which must be drawn up by regions and municipalities, supported by targeted financing programmes. The implementation of energy management systems will make a substantial contribution in this direction. In any case, a key priority for public buildings will be to promote measures and programmes that are technically feasible and optimal in terms of social costs and results.

The new minimum requirements will be incorporated in the revised Regulation on Energy Efficiency of Buildings and emphasis will be placed on increasing the number of near-zero energy buildings in accordance with the requirements of Directive 2010/31/EU.

The adoption of new regulatory measures (also in the context Directive 2010/31/EU, as amended by Directive (EU) 2018/844) will aim both at elaborating an appropriate framework and creating incentives for maximising the number of buildings which would exceed the minimum energy efficiency requirements.

For example, the following regulatory provisions will be promoted:

- ✓ After 31 December 2023, all buildings housing public authorities must be classified under energy category B or higher on the basis of the energy performance certificate.
- ✓ As of 1 January 2021, all new buildings or building units rented or purchased by central government bodies must be near-zero energy buildings (energy category A or higher).
- ✓ As of 1 January 2021, for each building or building unit that is available for sale or rent, the energy efficiency index shown in the energy performance certificate should be declared in all commercial advertisements.

Successful and efficient policy measures, such as the mandatory installation of solar thermal systems in new buildings and those undergoing major renovation, will be continued and improved as appropriate. Finally, the new regulatory framework, coupled with tax, financial and town planning incentives, is expected to increase the pace of energy upgrading of private buildings.

All the above policy measures will be analysed and further specified in the context of the long-term strategy for the renovation of the building stock.

Renovation of the building stock

Improving the energy efficiency of Greece's building stock is a key priority of the national energy plan. Successful financing programmes will be continued and adjusted, to make them more cost-effective by increasing the levels of leverage and to ensure effective contribution towards protecting vulnerable social groups in the population.

An effort will be launched in this direction for the energy upgrading of **12-15% of buildings and/or building units** in the decade 2021-2030 through targeted policy measures designed and implemented in the context of the implementation of the NECP by 2030.

Overall, the energy upgrading of the building stock is expected to **increase added value by EUR 8 million** and create and maintain over **22 thousand new full-time jobs.**

Finally, a specific mechanism will be developed to monitor, measure and assess the degree of attainment of the target and the anticipated economic and social benefits.

3.4.3 Policies and measures to promote energy services in the public sector

Improving the energy efficiency of public buildings through **energy performance contracts and generally through PPPs** will be one of the key policy measures in the following period. Therefore, an immediate priority is to adjust the relevant framework of support financing programmes and of support structures in order to address the technical and administrative difficulties detected, with a view to further developing energy services in public buildings.

A major contribution to the above pursuits will be made by the redrafted ILEKTRA programme, consisting in financing energy efficiency interventions in general government buildings, including participation in the implementation of interventions by energy service companies through energy performance contracts.

Moreover, the further development of energy services should contribute towards putting in place sustainable solutions for improved energy efficiency of private buildings. The regulatory framework will be completed and improved taking into account the experience gained to date, whereas the necessary framework for easier access to funding under favourable terms for the parties involved will be developed.

ILEKTRA programme

The key aim of the programme is to create attractive and sustainable energy upgrade investments for the buildings used by public bodies (general government bodies), by effectively leveraging funds from both the private and public sector. The adjustment of the regulatory framework facilitates the mobilisation of private funds in a sector with considerable potential, which will contribute significantly towards attaining the ambitious objectives of the national plan for the energy upgrading of buildings.

More specifically, the ELEKTRA programme strengthens the energy upgrading of public buildings by financing part of the required investments through investment loans, which will be repaid by the programme. It also provides for the participation of energy service companies, whereas payments to them, in the context of energy performance contracts, are guaranteed through securities.

3.4.4 Other planned policies, measures and programmes to attain the indicative national energy efficiency target for 2030

Implementing specific measures to improve energy efficiency in infrastructure is expected to yield significant results. For example, priority is given to projects for promoting HECHP plants, deploying district heating and cooling networks, and expanding gas distribution networks, including the deployment of autonomous compressed (CNG) and liquefied natural gas (LNG) networks. Focus will be given to the implementation of the policy measures to be proposed in the context of the comprehensive assessment for promoting efficient heating and cooling, which is expected to be completed by the end of 2020. Priority will be given to the use of waste heat under these policy measures, in industrial and crafts establishments in particular.

Existing mechanisms to support energy efficiency improvement measures, such as the energy upgrade programme for street lighting by local authorities, will continue, and further financing instruments will be promoted to modernise water supply and irrigation infrastructure (network replacement, remote control/command systems, replacement of older pumps with new ones, more energy-efficient ones, etc.), which are also expected to have a significant impact on energy savings and at the same time on the cost of providing water services.

In the context of a holistic approach, the planning and implementation of policy measures in the building, transport and network sectors is taking place with a view to promoting innovative smart city models. In this context, both buildings and vehicles, as independent entities, will be capable of communicating and interacting through support structures based on the use of advanced ICTs. Smart meters and smart networks will form a key part of these plans, allowing for the monitoring and management of the large amounts of information that will be necessary for their harmonious operation. When completed, the programme for the deployment of smart meters will contribute significantly towards the rational use of energy by final consumers. Furthermore, combined with the new regulatory framework for the demand response mechanism, better electricity balancing and peak load management are to be achieved.

The energy savings potential related to the correct implementation of the EU legislative framework for ecodesign and energy labelling of products will be best utilised through systematic controls of their implementation. Information actions on energy efficiency will also contribute to awareness-raising and, ultimately, to encouraging final consumers to adopt more rational practices of energy use. Both upgrading the role of energy performance certificates — by looking into alternative ways of converting them into tailored roadmaps for the energy upgrading of buildings or building units — and developing new certification schemes for installers to ensure the proper implementation of energy savings interventions and the maximum utilisation of the options offered by the relevant technologies are expected to make a contribution in this direction.

Additional horizontal actions contributing to the implementation of energy upgrades in the building sector are both the development of a common and open database and the establishment of a legislative framework for setting up innovative technology procurement groups, as well as the use of innovative digital models for the construction and management of buildings over their lifecycle. The aim of the database will be to better identify the relevant savings potential of the projects under preparation and to facilitate benchmarking between similar buildings through the available energy features of listed buildings and ex-post data of energy savings projects with a view to mitigating the risk of relevant investments. Accordingly, the setup of innovative technology procurement groups will lead to lower costs for the design and implementation of energy savings measures.

Green procurement is expected to play a major role in the new period through the inclusion of criteria for the promotion of highly energy-efficient technologies and services, while at the same time demonstrating the exemplary role of the public sector.

Policy measures in the transport sector, which are expected to be further specified in the context of the strategic plan for transport, are a priority for the new period, just like the completion of the infrastructure needed to promote alternative fuels in transport, the consideration of new regulatory measures, the revision of the existing institutional framework for the development of a market in alternative fuel infrastructures and the adoption of tax incentives for all types of alternative fuels.

More specifically, the promotion of electromobility is a key priority in the transport sector. An analysis of policy measures for promoting electromobility is provided in Chapter 3.3.

In respect of the use of natural gas in road transport, the use of liquefied natural gas (LNG) as fuel for heavy vehicles is of particular interest. In this context, plans are being made to deploy a network of 8 LNG refuelling stations by 2030. The network of compressed natural gas (CNG) refuelling stations for vehicles is being deployed, whereas provision has been made for 55 CNG stations to be in operation throughout Greece by 2030, to meet the relevant demand. Finally, the relevant institutional framework has already been drawn up, and there is appropriate know-how in the market in such matters as the establishment and operation of CNG stations, vehicle retrofit shops, technicians, car repair shops and technical control centres (KTEOs) for CNG vehicles, as well as transport of CNG by road to users outside the gas pipeline network.

Moreover, the implementation of infrastructure projects in the field of road and rail transport, combined with the drafting of plans for a shift in commercial transport operations, is expected to significantly improve energy efficiency in the sector.

Sustainable urban mobility plans will play a major role in improving energy efficiency in the transport sector by incorporating the key principles of circular and cooperative economy. Sustainable urban mobility plans will cover all modes and means of transport, including public transport and active modes of travel, such as walking and cycling, as well as shared means of movement and smart mobility. On a complementary basis, targeted actions, such as bioclimatic restructuring programmes, will be launched in conjunction with sustainable urban mobility plans.

Furthermore, priority will be given to the definition of a compulsory quota of vehicles with higher energy efficiency in public agencies and organisations by setting higher energy efficiency limits, while at the same time making plans for upgrading public transport by the use of new technology vehicles to the extent that this is efficient in financial, technological and energy terms.

Finally, the replacement of passenger vehicles and light goods vehicles with new high energy efficiency ones will be promoted through a combination of measures such as planning a targeted programme for passenger vehicle scrapping, putting in place a more effective legislative framework to link vehicle taxation to energy efficiency and CO_2 emissions, and implementing a broader financing programme for the replacement of public and freight vehicles with low-emission ones. Please note that the market in vehicles using alternative fuels will contribute significantly towards improving energy efficiency in the road transport sector.

As regards converting existing vehicles to use alternative fuels, it is necessary to put in place an appropriate institutional framework for certifying the conversion of such vehicles.

The existing framework for mandatory energy audits on large enterprises will facilitate the promotion of similar audits on SMEs and households. Furthermore, incentives will be established for implementing the energy savings measures proposed through energy audits not only to obliged large enterprises, but also to SMEs and households. Moreover, new measures will be developed to support the implementation of energy management systems in SMEs in order to keep improving their energy efficiency.

In the industrial sector, the existing programmes for the provision of financial incentives to improve the energy efficiency of industries and manufacturing enterprises will continue in the new programming period and, in addition to that, the measure for the relocation of industrial plants to industrial-business zones will be strengthened. New policy measures will support actions at an industrial-business zone level for better energy management and increased savings, such as central heat production and distribution systems.

Furthermore, the promotion of natural gas as fuel in industries established far from the high pressure network through the transportation of liquefied natural gas is expected to be important. In the same context, the production of energy from the utilisation of waste heat and the replacement of conventional fuels with alternative ones will be promoted.

Finally, special financing mechanisms will be designed to strengthen the implementation of energy efficiency improvement measures in the industrial sector through energy performance contracts, such as subsidising borrowing costs and facilitating access of energy services companies to financing.

Finally, a specific package of policy measures aimed at improving energy efficiency in the agricultural sector is currently being considered. For example, a measure to improve the energy efficiency of pumping stations, as well as new measures such as the energy upgrading of agricultural machinery and the reduction in energy consumption in greenhouses and livestock farms are being planned.

3.4.5 Policies and measures to promote the role of local energy communities

More active involvement of stakeholders at local and regional levels will be ensured initially by drawing up both the Action Plans for Sustainable Energy and the Action Plans for Energy Efficiency of Buildings under the responsibility of regions and municipalities and then by implementing the proposed interventions with support from targeted financing programmes under the regional operational programmes for the new programming period.

These may also make a crucial contribution towards specific policy measures, such as promoting energy services in the public sector through specific demonstration projects, facilitating obliged parties in the context of the obligation scheme through the concentration of candidate energy savings projects and the development of sustainable urban mobility plans and a shift in transport operations.

Finally, focus should be given to actions aimed at ensuring that the energy communities scheme contributes both to the use of waste to produce electricity or biomethane for use in transport, as well as to the implementation of energy upgrading projects by the use of recyclable materials.

3.4.6 Measures to exploit the energy efficiency potential of gas and electricity infrastructure

Specific measures to improve the energy efficiency of electricity and gas infrastructures will be implemented by operators in the context of development programmes, focusing on energy efficiency improvement in transmission, distribution and load management, network interoperability, and energy generating installations, including micro energy generators.

Electricity and gas infrastructure operators will prepare reports describing the actions implemented regarding transmission, distribution, load management and interoperability, and connection to energy generating installations, including access possibilities for micro energy generators. Moreover, concrete measures and investments will be identified for the introduction of cost-effective energy efficiency improvements in the network infrastructure, with a timetable for their introduction.

Finally, consideration will be given to modifying the existing framework for the determination of regulated charges, granting an incentive to transmission and distribution network operators of enjoying a higher return on invested capital if they attain specific energy efficiency improvement targets.

3.4.7 Measures to improve energy efficiency under Article 7

The energy savings objective under Directive (EU) 2018/2002 on energy efficiency in the period 2021-2030 amounts to 7,299 ktoe of cumulative energy savings taking into account the obligation to achieve energy savings annually equal to 0.8% of the average final energy consumption of the 2016-2018 period (Table 19).

Please note that the energy savings objective was calculated on the basis of a provisional estimate of final energy consumption for 2018 (16 317 Ktoe), as opposed to the years 2016 and 2017 for which official data published by EUROSTAT (16 694 and 16 752 Ktoe, respectively) were used.

Table 19: Setting the energy savings objective under Article 7 of Directive (EU) 2018/2002.

Year	Energy savings on an annual basis (Ktoe)										Cumulative savings
2021	132.7										**133**
2022	132.7	132.7									**265**
2023	132.7	132.7	132.7								**398**
2024	132.7	132.7	132.7	132.7							**531**
2025	132.7	132.7	132.7	132.7	132.7						**664**
2026	132.7	132.7	132.7	132.7	132.7	132.7					**796**
2027	132.7	132.7	132.7	132.7	132.7	132.7	132.7				**929**
2028	132.7	132.7	132.7	132.7	132.7	132.7	132.7	132.7			**1,062**
2029	132.7	132.7	132.7	132.7	132.7	132.7	132.7	132.7	132.7		**1,194**
2030	132.7	132.7	132.7	132.7	132.7	132.7	132.7	132.7	132.7	132.7	**1,327**
Total											**7,299**

This energy savings objective will be attained by combining energy efficiency obligation schemes with a mix of alternative policy measures (Table 20).

More specifically, energy efficiency obligation schemes will account for 20% of the total cumulative objective for the period 2021-2030, whereas a total of nine alternative policy measures will be implemented to cover the remaining part of the objective, reflecting the key policy priorities and the most important energy efficiency improvement measures.

A detailed description of the alternative policy measures and of the basic principles of the energy efficiency obligation schemes is given in a relevant computer file developed using the format proposed by the Regulation, regarding all technical issues relating to the correct application of Article 7.

Table 20: Mix of policy measures to attain the objective under Article 7 of Directive (EU) 2018/2002.

No	Policy measure	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total new EU (Ktoe)	Total cumulative EU (Ktoe)
1	**Energy upgrading of residential buildings**	52	52	52	52	52	52	52	52	52	52	**523**	**2,878**
2	**Energy upgrading of public buildings**	4	4	4	4	4	4	4	4	4	4	**38**	**208**
3	**Energy upgrading of tertiary sector buildings and industrial plants**	8	8	8	8	8	8	8	8	8	8	**78**	**427**
4	**Improvement in energy efficiency through energy service companies**	4	4	4	4	4	4	4	4	4	4	**36**	**196**
5	**Energy managers in public buildings**	39	39	39	0	0	0	0	0	0	0	**116**	**1,042**
6	**Energy upgrading of pumping equipment**	12	12	12	0	0	0	0	0	0	0	**35**	**315**
7	**Energy upgrading of street lighting**	7	7	7	0	0	0	0	0	0	0	**20**	**180**
8	**Development of transport infrastructures**	5	5	5	5	5	5	5	5	5	5	**48**	**264**
9	**Promotion of alternative fuels in road transport**	6	6	6	6	6	6	6	6	6	6	**60**	**329**
10	**Energy efficiency obligation schemes**	66	66	66	66	66	66	66	66	66	66	**661**	**1,460**
Total new EU (Ktoe)		**201**	**201**	**201**	**144**	**144**	**144**	**144**	**144**	**144**	**144**	**1,614**	**7,299**
Total cumulative EU on an annual basis (Ktoe)		**201**	**383**	**528**	**617**	**706**	**795**	**884**	**973**	**1061**	**1150**		

3.4.8 Regional cooperation in this area, where appropriate

In terms of regional cooperation for promoting energy efficiency in all sectors and developing measures and policies, there is cooperation with the corresponding ministry of the German government as part of the TARES project.

Moreover, as referred to in Section 1.4 on regional cooperation in planning, Greece's participation through its representatives in CA-EED and CA-EPBD contributes significantly to cooperation between Greece and other Member States.

3.4.9 Financing measures including support from and use of EU funds in this area at a national level

The challenges resulting from the planning and implementation of the funding measures envisaged consist, inter alia, in maximising the expected leverage, using available State resources more efficiently, adopting innovative financing tools and mobilising the domestic financial sector more actively.

To that end, all available resources will be mobilised at national and EU levels, including the structural funds. Particular emphasis will be placed on the energy upgrading of the building stock through energy performance contracts and generally through PPPs.

The establishment of the Energy Efficiency Fund will significantly enhance the implementation of energy efficiency improvement measures in all energy consumption areas. More specifically, the Energy Efficiency Fund is expected to facilitate the access of stakeholders to financing, to help improve the cost-result indicator of the programmes implemented, and to allow for more effectively utilising the untapped potential for energy savings in specific sectors.

Also, the measure of tax relief through the doubling of depreciation rates for fixed assets used in energy savings investment by legal persons will continue. Similar tax relief measures will be further specified, such as tax exemption through expenditure on the energy upgrading of buildings, taking due account of the estimated impact on the Greek economy as a whole.

The implementation of a wholly new measure introducing tendering procedures for achieving energy savings is expected to give a significant boost to energy efficiency improvement in specific sectors, such as the tertiary and industrial sectors. This measure will aim at introducing tendering procedures to improve the cost-effectiveness of the technologies used and to reduce the risk of measures implemented by third parties through the grouping of small individual projects.

Finally, innovative and dedicated financing instruments will be designed to promote energy services more broadly and exploit the untapped potential for energy savings in specific sectors.

Implementation of new financing mechanisms and instruments (1/2)

The new financing instruments to be implemented will contribute primarily to the effective use of potentially available resources for improving energy efficiency and reducing carbon dioxide emissions. These include mobilising additional sources of funding from the Greek financial sector, the envisaged National Energy Efficiency Fund or the Structural Funds in the context of the new programming period 2021-2027.

National Energy Efficiency Fund

The National Energy Efficiency Fund is expected to provide the basis for the development of new financing tools, aiming to finance programmes and other measures for energy efficiency improvement and to develop the market in energy services. The Fund may serve as both **lending fund** and guarantee fund. Initially, part of the capital of the structural funds is expected to be transferred to the National Energy Efficiency Fund in order to support energy savings projects by considering the use of the **revolving capital** mechanism. The Fund's main activity can be to refinance loans from available funds from which loans are granted and in the context of which loan repayments are made and re-leased. Using this mechanism, the Energy Efficiency Fund can grant favourable loans to public authorities or to energy service companies with a view to implementing savings projects. To make investment more attractive, available funds may be used to subsidise part of the cost of the project or to further improve the conditions for financing loans to energy service companies or public authorities. Finally, advisory services are expected to be funded, to identify potential savings and monitor projects in order to ensure proper results.

Implementation of new financing mechanisms and instruments (2/2)

Innovative financing instruments for blended funding

Moreover, innovative **blended/hybrid finance** programmes will be designed in cooperation with the domestic financial sector. These programmes will combine public and private financing on favourable terms, to support energy efficiency improvement in specific sectors with a high potential, such as the tertiary, domestic and industrial sectors. In this direction, new mechanisms will be considered, such as: blended financing on favourable terms ('blended' concessional loans), lease-financing, risk-sharing instruments such as blended insurance and guarantee instruments, as well as mechanisms focusing on aggregation. Financing instruments can be used by energy service companies that need financing to implement energy efficiency plans in order to better manage repayment thereof, whereas consideration will also be given to extending their scope to include other sectors too (SMEs).

Tendering procedures for energy savings

The new measure of tendering procedures, in its pilot application, is expected to focus on final energy savings, thus making a significant contribution towards the attainment of the objective under Article 7. The measure will provide financial support for technical energy savings interventions in sectors with high potential, such as the industrial and tertiary sectors. Provision is made for the tendering procedure to focus primarily on the cost-effectiveness of the interventions and to conform to clear-cut guidelines for calculating and verifying the energy savings achieved. Moreover, the measure will be highly flexible as it will be open to all domestic enterprises, while it is expected to increase the competitiveness of energy savings investment projects.

3.4.10 Summary of policy measures

Table 21 summarises the policy measures envisaged with a view to attaining the individual energy efficiency objectives.

Table 21: Policy measures envisaged to improve energy efficiency.

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M1	**Promotion of energy performance contracts (EPCs) through targeted financing programmes.**	**PP3.1, PP3.3, PP3.5**	Objective of Article 3 Objective of Article 7 Objective of Article 4 Objective of Article 5	Tertiary sector, public buildings	Economic measure
M2	**Financing programmes for the renovation of public buildings in the context of the new programming period.**	**PP3.1, PP3.5**	Objective of Article 3 Objective of Article 7 Objective of Article 4 Objective of Article 5	Tertiary sector, public buildings	Economic measure
M3	**Financing of public building upgrades on the basis of the Action Plans for Sustainable Energy and the Action Plans for Energy Efficiency of Buildings under the responsibility of municipalities and regions.**	**PP3.1, PP3.5**	Objective of Article 3 Objective of Article 7 Objective of Article 4 Objective of Article 5	Tertiary sector, public buildings	Economic measure
M4	**Improvement of regulatory framework and strengthening of the role of energy managers for public buildings.**	**PP3.1**	Objective of Article 3 Objective of Article 7 Objective of Article 4 Objective of Article 5	Tertiary sector, public buildings	Regulatory measure
M5	**Promotion of energy management systems in public buildings.**	**PP3.1**	Objective of Article 3 Objective of Article 7 Objective of Article 4 Objective of Article 5	Tertiary sector, public buildings	Regulatory, economic measure
M6	**Regulatory measures to promote near-zero energy buildings (nZEBs).**	**PP3.1, PP3.2**	Objective of Article 3 Objective of Article 4 Objective of Article 5	Tertiary sector, public buildings	Regulatory measure
M7	**Regulatory, tax and financial incentives to promote buildings exceeding minimum energy requirements (nZEBs).**	**PP3.1, PP3.2, PP3.5**	Objective of Article 3 Objective of Article 7 Objective of Article 4 Objective of Article 5	Tertiary sector, public buildings	Regulatory, economic measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M8	**Financing programmes for the renovation of residential buildings in the context of the new programming period.**	**PP3.2, PP3.5**	Objective of Article 3 Objective of Article 7 Objective of Article 4	Residential sector	Economic measure
M9	**Financing programmes for the renovation of tertiary sector buildings (other than public buildings) in the context of the new programming period.**	**PP3.2, PP3.5**	Objective of Article 3 Objective of Article 7 Objective of Article 4	Tertiary sector - Buildings other than public buildings	Economic measure
M10	**Promotion of energy performance contracts (EPCs) in the private sector through targeted financing programmes.**	**PP3.2, PP3.3, PP3.5**	Objective of Article 3 Objective of Article 7 Objective of Article 4	Tertiary sector - Buildings other than public buildings	Economic measure
M11	**Use of tax and town planning incentives for implementing energy savings interventions in residential buildings and tertiary sector buildings (other than public buildings).**	**PP3.2**	Objective of Article 3 Objective of Article 7 Objective of Article 4	Residential sector Tertiary sector, Buildings other than public buildings	Regulatory, economic measure
M12	**Mandatory installation of solar thermal systems in new buildings and in buildings undergoing major renovation.**	**PP3.2, PP3.11**	Objective of Article 3 Objective of Article 7 Objective of Article 4	Residential sector Tertiary sector, Buildings other than public buildings	Regulatory measure
M13	**Strengthening of the role and improvement of the regulatory framework for energy efficiency obligation schemes.**	**PP3.4**	Objective of Article 3 Objective of Article 7 Objective of Article 4 Objective of Article 5	All final consumption sectors	Regulatory measure
M14	**Implementation of tender procedures for achievement of energy savings.**	**PP3.4**	Objective of Article 3 Objective of Article 7 Objective of Article 4	All final consumption sectors	Economic measure
M15	**Design of framework for setting up innovative technology procurement groups.**	**PP3.4**	Objective of Article 3 Objective of Article 7 Objective of Article 4	All final consumption sectors	Regulatory measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M16	**Promotion of energy audits in SMEs and in households.**	**PP3.12**	Objective of Article 3 Objective of Article 7 Objective of Article 4	Industrial, tertiary and residential sector	Economic measure
M17	**Financing programmes for the application of the recommendations of energy audits to obliged or non-obliged parties.**	**PP3.5, PP3.6**	Objective of Article 3 Objective of Article 7 Objective of Article 4	Industrial and tertiary sector	Economic measure
M18	**Promotion of energy management systems in SMEs.**	**PP3.2, PP3.6**	Objective of Article 3 Objective of Article 7 Objective of Article 4	Industrial and tertiary sector	Economic measure
M19	**Establishment of the National Energy Efficiency Fund.**	**PP3.5**	Objective of Article 3 Objective of Article 7 Objective of Article 4 Objective of Article 5	All final consumption sectors	Regulatory, economic measure
M20	**Scheme for the certification of installers of building elements that affect the energy behaviour of buildings.**	**PP3.12**	Objective of Article 3 Objective of Article 4	All final consumption sectors	Regulatory measure
M21	**Strengthening of the role of energy performance certificates by amending and upgrading them.**	**PP3.12**	Objective of Article 3 Objective of Article 7 Objective of Article 4 Objective of Article 5	Tertiary and residential sector	Regulatory measure
M22	**Completion of a programme for the installation of individual smart meters.**	**PP3.9, PP3.12**	Objective of Article 3 Objective of Article 7	Tertiary and residential sector	Technical measure
M23	**Development of the regulatory framework for demand response.**	**PP3.9, PP3.12**	Objective of Article 3 Objective of Article 7	All final consumption sectors	Regulatory measure
M24	**Financing programmes for the energy upgrading of street lighting.**	**PP3.5**	Objective of Article 3 Objective of Article 7	Tertiary sector	Economic measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M25	**Financial and tax support for investment in energy savings technologies.**	**PP3.2, PP3.5, PP3.6**	Objective of Article 3 Objective of Article 7	All final consumption sectors	Economic measure
M26	**Implementation of information actions on energy efficiency.**	**PP3.12**	Objective of Article 3 Objective of Article 7	All final consumption sectors	Information and awareness-raising measure
M27	**Promotion of energy-efficient products through the implementation of energy labelling and of the ecodesign Directive.**	**PP3.12**	Objective of Article 3	All final consumption sectors	Regulatory measure and information and awareness-raising measure
M28	**Promotion of green public procurement.**	**PP3.1, PP3.7**	Objective of Article 3 Objective of Article 5	Public sector	Regulatory, economic measure
M29	**Financing programmes for promoting HECHP, district heating/cooling in the context of the new programming period.**	**PP3.5, PP3.11**	Objective of Article 3 Objective of Article 7 Objective of Article 4 Objective of Article 5	All final consumption sectors	Economic measure
M30	**Expansion of natural gas distribution networks and deployment of autonomous compressed and liquefied natural gas networks**	**PP3.9**	Objective of Article 3 Objective of Article 4 Objective of Article 5	All final consumption sectors	Technical, economic measure
M31	**Promotion of innovative smart city models through the use of state-of-the-art technologies.**	**PP3.9**	Objective of Article 3 Objective of Article 7	All final consumption sectors	Technical measure
M32	**Creation of database for energy characteristics of buildings and energy upgrading actions**	**PP3.12**	Objective of Article 3 Objective of Article 7 Objective of Article 4 Objective of Article 5	All final consumption sectors	Information and awareness-raising measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M33	**Financing programmes for improvement in the energy efficiency of industries and processors in the context of the new programming period, including the promotion of EPCs.**	**PP3.3, PP3.5, PP3.6**	Objective of Article 3 Objective of Article 7	Industrial sector	Economic measure
M34	**Promotion of the relocation of industrial plants to industrial-business zones.**	**PP3.6**	Objective of Article 3 Objective of Article 7	Industrial sector	Economic measure
M35	**Promotion of central heat generation and distribution systems at an industrial-business zone level**	**PP3.6**	Objective of Article 3 Objective of Article 7	Industrial sector	Technical, economic measure
M36	**Compulsory quotas of vehicles with higher energy efficiency in the fleets of public agencies or organisations.**	**PP3.1, PP3.7**	Objective of Article 3	Transport sector	Regulatory measure
M37	**Promotion of use and improvement of energy efficiency of urban public transport systems.**	**PP3.8**	Objective of Article 3 Objective of Article 7	Transport sector	Technical, economic measure
M38	**Implementation of infrastructure projects which are currently in progress in the (road and railway) transport sector.**	**PP3.8**	Objective of Article 3 Objective of Article 7	Transport sector	Technical measure
M39	**Elaboration of sustainable urban mobility plans.**	**PP3.8**	Objective of Article 3 Objective of Article 7	Transport sector	Regulatory measure
M40	**Elaboration of plans and implementation of infrastructures for a shift in commercial transport operations.**	**PP3.8**	Objective of Article 3 Objective of Article 7	Transport sector	Regulatory measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M41	**Use of tax incentives to promote alternative fuels in transport (biofuels, hybrid fuels, electric fuels, natural gas, LPG).**	**PP3.7, PP3.8**	Objective of Article 3 Objective of Article 7	Transport sector	Economic measure
M42	**Completion of the institutional support framework for the deployment of infrastructures for promoting alternative fuels in transport (recharging stations for electric vehicles, natural gas, etc.)**	**PP3.7**	Objective of Article 3	Transport sector	Regulatory, technical measure
M43	**Implementation of a programme for the replacement of passenger vehicles and light goods vehicles with new high energy efficiency ones.**	**PP3.7**	Objective of Article 3 Objective of Article 7	Transport sector	Economic measure
M44	**Regulatory measures for energy savings in the transport sector**	**PP3.12**	Objective of Article 3 Objective of Article 7	Transport sector	Regulatory measure
M45	**Promotion of measures for improving energy efficiency in electricity infrastructures.**	**PP3.9**	Objective of Article 3	Electricity infrastructure	Regulatory, technical measure
M46	**Promotion of measures for improving energy efficiency in natural gas infrastructures.**	**PP3.9**	Objective of Article 3	Gas infrastructures	Regulatory, technical measure
M47	**Promotion of measures for modernising water supply / sewage and irrigation infrastructures, to save both water and energy.**	**PP3.10**	Objective of Article 3 Objective of Article 7	Water infrastructures	Technical, economic measure

3.5 Energy security

The definition of policy measures for security of supply over the period 2021-2030 aims to cover five different policy priorities (PP4.1-PP4.5), which are presented in Figure 7.

PP4.1: Increasing diversification of energy sources and import routes

PP4.2: Highlighting Greece's profile as a regional energy hub

PP4.3: Reducing energy dependency and developing domestic energy sources

PP4.4: Promoting flexibility, storage and response systems and ensuring Greece's power adequacy

PP4.5: Readiness of Greece to cope with constrained or interrupted energy supply

Figure 7: Policy Priorities for Security of Supply in the period 2021-2030.

The main priority of the country is to increase diversification of sources and import routes in order to enhance security of energy supply. At the same time, reducing energy dependence while developing domestic energy sources, compatible with the objectives of enhancing RES penetration, is obviously a constant priority, especially in the context of long-term energy planning. However, as long as this energy dependence remains high and to avoid events such as the energy crisis that the country faced in 2008-2009 and more recently, at the end of 2016 and early 2017, diversification of energy sources and suppliers from third countries is needed, so as not to depend on a single fuel or a single geographical area or a single pipeline, to promote RES penetration and, most importantly, to promote energy efficiency improvement actions, which should be a top priority in all aspects of energy planning in the country.

Moreover, with a view to ensuring the country's power adequacy, strengthening flexibility systems to allow high penetration of RES plants, and reducing energy dependence, it is necessary to further strengthen Greece's interconnections with neighbouring and adjacent countries, to promote the deployment of new high energy-efficiency power plants with high response rates, to install electricity storage systems and to promote demand response systems. Meanwhile, the promotion of major electricity and gas transmission projects, the exploitation of potential domestic hydrocarbon resources and the development of storage systems aim to transform Greece into a regional hub that will help increase cross-border energy flows and the security of energy supply of the European Union, in general.

However, in addition to the measures taken to strengthen the country's position in the region, measures must be taken to ensure the readiness of the country and stakeholders to respond to the reduction and/or interruption of energy resources and, in this context, to provide for concrete initiatives and implementation of regulatory mechanisms.

The policy measures that have been specified in the above policy priorities are analysed separately in the following sections.

3.5.1 Policies and measures to achieve the relevant objectives

3.5.1.1 Policies and measures to increase diversification of energy sources and suppliers from third countries

Each country has as its main policy priority to increase diversification of energy sources and to increase the number of third countries that supply our country with oil, gas and electricity, in order to safeguard its energy supply and prevent energy shortages that will lead to significant economic damage to many sectors of its economy.

A measure to meet this priority is to provide incentives to increase domestic energy production, either through the development of new RES plants, coupled with electricity storage systems, or through the exploitation of domestic hydrocarbon resources.

In addition, important policy measures to meet this priority are promoting gas transportation and storage projects that will enable the supply of fuel from more countries, developing gasification infrastructures in areas currently based on oil use to enhance the use of dual fuel, and further enhancing the country's electricity and gas interconnections with neighbouring markets to help ensure uninterrupted energy flow.

A more specific policy measure to this end is to develop or modify the existing power plants so that they can use more than one type of fuel, e.g. gas and oil, but also to promote local electricity generation systems, which will either participate in or become part of the market in times of energy crisis.

3.5.1.2 Policies and Measures to Reduce Energy Dependence and Develop Domestic Energy Sources

The country's political priority is to take measures to reduce energy imports while developing domestic energy sources.

The country's high dependence on oil and gas is due to their high share of use in transport, industry and heating, as well as in electricity generation, with particular emphasis on the Non-Interconnected Islands (NII), where over 80% of electricity demand is covered by conventional oil power plants.

Replacing imported fuel from RES in both electricity generation, the transport and the heating and cooling sector will reduce energy dependence, since RES, with the exception of biofuels, are a domestic source, to the extent that they are not of EU origin. In general, the projected growth of domestic energy sources in all sectors will reduce energy dependence to some extent.

However, the projected improvement in energy efficiency, and consequently the significant reduction in projected energy demand, are also crucial. Achieving energy efficiency improvement targets will make a crucial contribution to improving energy dependence indicators and is a key horizontal priority and prerequisite for achieving both the objective of the security of energy supply and the penetration of RES and the reduction of greenhouse gas emissions.

A number of policy measures are also being promoted, especially for the NIIs, which will help reduce the country's energy dependence. More specifically, in the decade 2021- 2030, it is expected that most of the NIIs will be interconnected with the continental electricity system, which will result in a further reduction in the need for oil imports for electricity generation purposes.

In particular, new interconnections of Greece's islands, which now operate as autonomous electrical systems, based mainly on oil power plants, with the mainland system are being promoted. With the recent completion of the first phases of the Cyclades Interconnection by ADMIE, the electrical systems of Paros (including Naxos, Antiparos, Ios, Sikinos, Folegandros, etc.), Syros and Mykonos were interconnected. The majority of the Aegean islands (Crete, rest of the Cyclades islands, Dodecanese islands, NE Aegean) will also be interconnected with the Hellenic Electricity Transmission System (HETS) in the period 2020-2030, starting with the interconnection of Crete, which will have been completed at the beginning of the following decade. The aim is that, by the end of the following, decade almost all of these autonomous systems will have been connected to the interconnected system.

The interconnections already launched by ADMIE and/or its affiliates (Table 22) include:

- the completion of the interconnection of the Cyclades islands
- the interconnection of Crete (Phases I and II)
- the interconnection of the Dodecanese islands
- the interconnection of the North Aegean islands.

Table 22: Interconnection Implementation Plan.

Internal Interconnections	Interconnection of Cyclades	Phase A: Lavrion - Syros - Tinos - Mykonos	2018
		Phase B: Paros - Naxos, Naxos - Mykonos	2019
		Phase C: Second Lavrion - Syros interconnection (2nd cable)	2020
		Phase D: Western and Southern Cyclades	2023-2024: Interconnection 2025: Year of full operation
	Interconnection of Crete	Phase I: 150kV, 2x200 MVA	2020: Interconnection 2021: Year of full operation
		Phase II (Ariadne): The HETS undertakes all the load of Crete	2022: Interconnection 2023: Year of full operation
	Interconnection of the Dodecanese islands*		2027: Interconnection 2028: Year of full operation
	Interconnection of the Northern Aegean islands**		2028: Interconnection 2029: Year of full operation
International Interconnections	2nd Interconnection with Bulgaria, 600 MW		2023: Year of full operation

** The interconnection of the Dodecanese islands includes the High Voltage interconnection of the islands of Kos, Rhodes and Karpathos and, through them, the Medium Voltage interconnection of the islands of Kasos, Halki, Kalymnos, Pserimos, Telendos, Nisyros, Tilos, Leros, Lipsi, Gyali, Patmos, Arkoi, Marathi and Symi.*

*** The interconnection of the Northern Aegean islands includes the High Voltage interconnection of the islands of Lemnos, Lesvos, Skyros, Chios and Samos and, through them, the Medium Voltage interconnection of the islands of Ikaria and Agathonisi.*

For some smaller islands, which are expected to remain autonomous for the coming years, it is also expected, as mentioned above, to significantly reduce the use of oil for electricity generation, while increasing the utilisation of local RES and the installation of storage units.

Particularly regarding islands for which no interconnection is planned, at least not for a long time, to reduce the energy dependence of these islands, a significant reduction in oil use for power generation is being promoted, with the installation of modern RES units combined with storage technologies. In particular, a policy measure to make this possible is the adoption of an appropriate institutional framework for the promotion of electricity storage systems, either within hybrid plants or within an independent central warehouse that will address grid saturation and allow the installation of new uncontrolled RES stations, or in the context of installing low capacity storage systems in conjunction with any new RES station. In this direction, it is noted that the installation of hybrid RES plants is promoted, either through private projects or through pilot projects such as the CRES's project for the conversion of Ai Stratis into a 'green island' and the Hellenic Electricity Distribution Network Operator's project for 'smart islands', and two hybrid RES plants have been put into operation on the island of Tilos (with battery) and on the island of Ikaria (with pumped storage). Moreover, Greece participates actively in the new EU initiative 'Clean Energy for EU Islands'.

The dynamic penetration of RES, which are called to make a significant contribution to the energy mix of the post-lignite era in Greece and which have been extensively discussed in a previous section, in the period of the European energy transition, should be combined with natural gas that will be the main transitional fuel until the European economy becomes climate neutral.

Greece continues to be a growing market in the exploration and production of natural gas in the Eastern Mediterranean. Both the hydrocarbon exploration and exploitation programme in Greece and the programme of TAP (Inter-Adriatic) pipelines, Interconnection of Greece-Bulgaria (IGB) and East-Med pipelines, are important projects that enhance the diversification of EU energy supply and ensure the security of supply to reduce energy dependence on third countries.

Although hydrocarbon exploration and exploitation in Greece has been an official policy since 1960, it has not been translated into a project to the extent one would expect. Significant steps to design and implement this policy have been taken at a technocratic level only in the last decade. Examples include the completion of the legislative framework, the elaboration of procedures and practices, the establishment of the Hellenic Hydrocarbon Resources Management Company (HHRM) as a State management body for this activity, and the conduct of studies to develop programmes in areas of Greece.

Figure 1: Concessions for hydrocarbon exploration and exploitation.

The Hellenic Republic has today assigned 13 maritime and inland areas, including Prinos where the production of crude oil has been going on for four decades, through concession contracts to joint ventures. It is the first time the country has received a large number of concessions, with contractors being mainly European international companies operating on a global scale. The first drillings are expected to be carried out in the ‘Patraikos Gulf’ and ‘Katakolo’ in 2020, with the aim of gradually moving from north to south, starting in western Greece and then in the west-southwest areas of Crete.

The country’s secondary and tertiary sectors will have some significant benefits. A number of accompanying projects should include a large port to support exploration and production activities in remote offshore segments. A significant factor will be the depth of water for boat access, storage of equipment and waste treatment. If exploitable stocks are discovered, companies will move into the development of facilities that will cost billions of euros, which will require local involvement and lead to business opportunities in the country, always adopting the best practices of countries with a long tradition in the field, such as Norway. Given these long-term investments, organised training plans will be developed that will allow Greece to build competitive human resources, which is one of the most important components of sustainable development.

The State, through the HHRM, also pays particular attention to safety issues related to the exploration and exploitation of hydrocarbons and thus to environmental protection. Environmental risks are dealt with by the relevant departments of the Ministry of Environment and Energy, which determines the terms and conditions, and approves the implementation steps. As a competent authority, the HHRM monitors, inter alia, the implementation of these contractual obligations by the agents and their associates and intervenes if there are any derogations by any of them. For these reasons, the National Emergency Response Plan for Offshore Hydrocarbon Facilities is being prepared by the Ministry of the Environment and Energy, with the coordination of all relevant State agencies.

The Southern Ionian concessions, and especially west and south of Crete, are marked by high water depths where there are no earlier drillings, but the geological environment and geometrical structures of the subsoil have significant similarities to those of Egypt and Cyprus or even Israel, where large deposits of natural gas have been discovered in recent years.

The first phase of seismic exploration for vast sea areas began in October 2019 and will last 3 years. The second 3-year phase will follow, during which three-dimensional geophysical studies and site selection for drilling will be carried out over the next 2 years (third contractual phase of maritime concessions). It is expected that the drillings as part of the major maritime concessions will begin no earlier than 2025.

If major gas targets are identified in the South-Eastern Mediterranean, the eastern Mediterranean gas limit will shift to the west. By extension, Greece will increase its potential reserves, creating a new balance in its economic and energy balance. Meanwhile, this gas will be a new source of energy for the EU during its transition to a climate-neutral economy. Onshore and offshore drilling for the next five to seven years will allow the rate of exploitation of these deposits to be assessed.

The direct economic benefits of production for the Greek state on a twenty-five year period from the commencement of production will derive from income taxation and from production dividends and other consideration. At the same time, promoting a system of redistribution of hydrocarbon resources to support local economies affected by the lignite phase-out of electricity generation is expected to mitigate the direct and indirect impacts at the local level by making this feedback loop a public interest priority.

Therefore, in line with the rapid development of RES and the planning needed to upgrade and digitise power grids and energy efficiency improvement measures, Greece in the post-lignite era should make every effort within the next few years to produce natural gas from its own deposits so that it can gradually either cover most of its consumption (5-8 BCM/year) or export to neighbouring countries, which are also strongly energy-dependent on third countries.

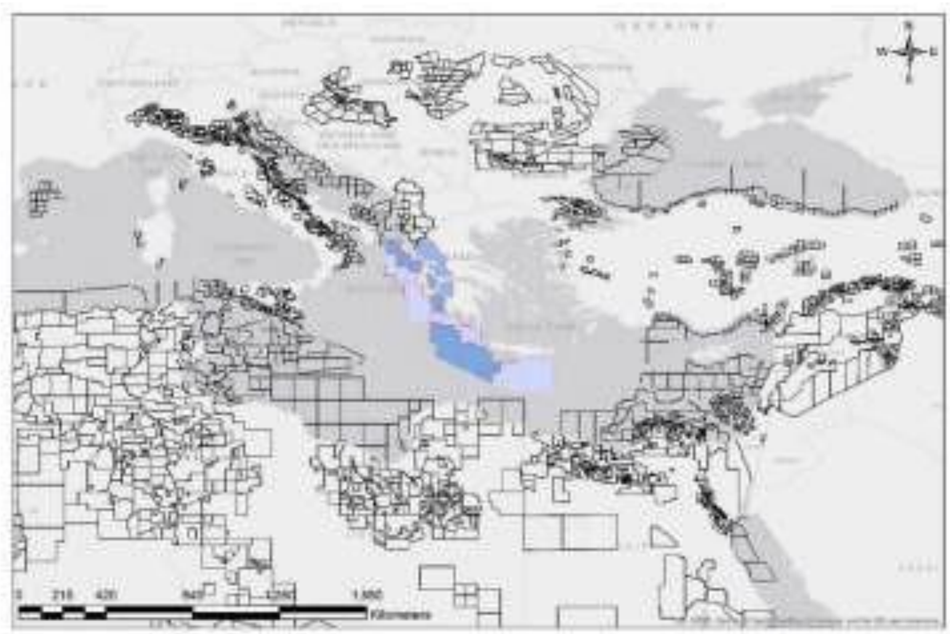


Figure 2: Concessions for hydrocarbon exploration and exploitation in the Mediterranean region[16].

3.5.1.3 Policies and measures to raise the country's profile as a regional energy hub

Raising the country's profile as a regional energy hub is inextricably linked both to boosting domestic electricity generation and electricity and gas storage capacity and to developing interconnections with neighbouring countries and developing gas transmission pipelines.

[16] Geographical distribution of concessions around the Mediterranean (black polygons). Onshore and offshore hydrocarbon exploration and exploitation concessions of Greece (deep blue). Recent HHRM study areas and evaluation of additional offshore areas with potential for gas and oil (light blue).

In the case of electricity it is contemplated to develop new interconnections and to reinforce the existing ones. The main projects of national and international interest in electrical interconnections and electricity storage units involve:

- the completion of the new interconnection line between Greece and Bulgaria (Maritsa - Nea Santa),
- the completion of the interconnection with Crete, supporting the prospect of the interconnection of Crete with Cyprus and, through Cyprus, with Israel,
- the investigation of new projects to strengthen existing interconnections between Greece and the Republic of North Macedonia and between Greece and Turkey,
- the interconnection of the majority of the non-interconnected islands to the Hellenic Electricity Transmission System (HETS), and
- the development of electricity storage systems, such as the Amphilochia pumped storage project.

Similarly, in the case of natural gas, it is expected that new interconnections be developed and the existing interconnections with neighbouring systems be reinforced, and that new natural gas pipelines be developed, which will have regional interest and strong transmission capacity towards third countries, strengthening Greece’s role as an energy hub. Specifically, NNGS development projects have been designed and launched within the framework of the approved Ten-Year Development Plans of the Hellenic Gas Transmission System Operator (DESFA).

Furthermore, according to the Natural Gas Market Roadmap, the most important projects of national and international interest concerning pipelines and gas storage units are:

- completion and operation of the TAP pipeline;
- operation of Revithoussa after the construction of the 3rd tank (increase of LNG storage), and the completion of works to further increase the rate of gasification of the Terminal’s drainage capacity;
- implementation of the gas interconnector Greece-Bulgaria (IGB);
- implementation of the Alexandroupolis Independent Natural Gas System Project (ASFA);
- design of the interconnector Turkey-Greece-Italy (ITGI);
- preparation works for the design and implementation of the East Med pipeline;
- implementation of the underground gas storage facility project in South Kavala; and
- implementation of the Greece - Republic of North Macedonia interconnection.

3.5.1.4 Policies and measures to promote flexibility, storage and response systems and ensuring the country's power adequacy

The country's security of supply is linked to the construction or maintenance of a sufficient electricity generation and interconnection capacity to meet a minimum degree of reliability for the country's energy system.

As regards the installation of sufficient power generation capacity, the policy measure that may accompany the operation of the electricity market is the implementation of appropriate power adequacy mechanisms.

Respectively, the projected increase in capacity between the National Electricity Transmission System and neighbouring systems, in addition to increasing the diversification of energy sources and supplier countries, will contribute to enhancing the capacity of the System.

Moreover, the new international interconnection projects, as well as the upgrade of existing interconnections, will significantly enhance the country's efforts to increase its power sufficiency and transform it into a regional energy hub.

Promoting demand response systems will also play an important role in ensuring power sufficiency, in addition to the installation of new power stations and the strengthening of interconnections. In the years to come, as part of the measures to reform the domestic electricity market and strengthen competition, measures will be promoted to increase participation of demand and, in general, of consumers in the electricity market.

It is noted that the existing institutional framework has incorporated provisions for promoting demand response systems. In particular, a transitional demand-side policy measure could also be the continuation of the application of the interruptible load mechanism, a measure which at this stage primarily concerns large electricity consumers who are able to reduce their consumption for the sake of system safety and price reduction of the wholesale electricity market.

With regard to **electricity storage,** particular benefits are expected, including the development and operation of uncontrolled/distributed RES sources, in particular due to the absorption of redundant energy, as the penetration of variable RES (mainly wind and solar photovoltaics) is increased and because of its contribution to ensuring the necessary power adequacy for the System, converting energy from uncontrolled sources into distributed energy. More specifically, provision is made for the utilisation and development of various forms of storage, also depending on the costs and the development of the relevant technologies (pumped storage, batteries, conversion into gas, etc.), as well as storage through the promotion of electromobility.

A key objective of centrally distributed storage systems is the development of storage units, including existing ones (Sfikia-Thisavros ~ 700 MW) and including projects of common interest (PCIs). The precise additional required power of storage systems, capacity, and technology of storage units will result from relevant studies that will be based on both the economic benefits they provide to the operation of the system and their contribution to power adequacy and flexibility of the System.

Policy measures to promote the installation of electricity storage systems may vary depending on the technology and type (centralised, dispersed) of the storage system (such as pumped storage projects in the area of *Amfilochia and Amari, Crete*). In particular, the promotion of centralised electricity storage systems is possible through the implementation of an appropriate purchasing mechanism, which will motivate the construction of storage systems over other electricity generation plants.

The promotion of dispersed low capacity electricity storage systems, which are installed with RES stations in the residential and business consumption areas of the country, is possible through the appropriate modification of the institutional framework which will allow or even oblige the installation of electricity storage systems for every new RES station or new residence that is built. More specifically, small and medium-sized dispersed storage units can also be operated through virtual units, thus enabling the technical optimisation of the total power of these units in the most cost-effective way and in the form of different products to the network providing power balancing at local level. It is worth noting that a policy measure to promote electricity storage systems, in order to enhance the power efficiency of the system, may also be the promotion of electricity. Vehicle batteries through a cumulative representation or even virtual units may constitute an important tool - a tool to enhance the system's power efficiency.

Respectively, according to the Natural Gas Market Roadmap, provision is made for the construction of the 3rd tank (increase of LNG storage), upgrade of berthing facilities (projects completed in 2018), and completion of works to further increase the rate of gasification of the Terminal's drainage capacity and the implementation of the project of the underground gas storage facility in South Kavala.

3.5.1.5 Policies and measures for the preparedness of Greece and of stakeholders to cope with contained or interrupted supply of an energy source

Regarding the preparedness of Greece and of stakeholders to respond to the limitation or interruption of energy supply, provision is generally made to maintain and/or enhance current gas related measures through the new, updated versions of the Preventive Action Plan and the Emergency Action Plan based on the recent results of the National and Joint Risk Assessment Study, and through the solidarity mechanism between neighbouring Member States that the country is required to adopt in accordance with the requirements of Regulation (EU) 2017/1938. Provision is also made to maintain and strengthen the measures contained in the regulation on keeping emergency oil stocks, and to elaborate the Electricity Risk Plan as a result of varying conditions (e.g. extreme weather, malicious attacks, lack of fuel) based on the corresponding EU Regulation. In addition, following its adoption by the European Commission, a new mechanism to ensure sufficient capacity for electricity production (Long-Term Power Adequacy Compensation), is planned to be established in the coming period. Finally, the development of a holistic risk and crisis protection and crisis management plan for critical energy infrastructure will be explored, incorporating all of the aforementioned plans and studies for all energy products and taking into account the specificities and other dimensions of the NECP.

3.5.2 Regional cooperation in this area

Concerning the security of energy supply with gas, it is noted that Greece participates in the following groups as provided for in Regulation (EU) 2017/1938:

1. East gas supply risk group:

- Ukraine: Bulgaria, Czech Republic, Germany, Greece, Croatia, Italy, Luxembourg, Hungary, Austria, Poland, Romania, Slovenia and Slovakia;
- Trans-Balkan gas supply group: Bulgaria, Greece and Romania.

2. North Africa gas supply risk group:

- Algeria: Greece, Spain, France, Croatia, Italy, Malta, Austria, Portugal, Slovenia;

3. South-East gas supply risk group (currently inactive):

- Southern Gas Corridor — Caspian Sea: Bulgaria, Greece, Croatia, Italy, Hungary, Malta, Austria, Romania, Slovenia, Slovakia;
- East Mediterranean: Greece, Italy, Cyprus, Malta.

Similarly, for electrical interconnections, Greece cooperates with neighbouring countries and ENTSOe regional groups.

Within the framework of international links, regional cooperations have already been launched with the following countries:

Albania	Cyprus
Bulgaria	Republic of North Macedonia
Israel	Turkey
Italy	

3.5.3 Financing of measures in this area at national level, inter alia with EU support and the use of EU funds

The key financial instruments include:

- Domestic resources
- Operational programmes under the new programming period
- Projects of Common Interest (PCIs)
- A specific financial instrument under the 4th EU-ETS period.
- Funding through the 'Connecting Europe' Facility (CEF)

3.5.4 Summary of policy measures

Table 23 summarises the policy measures planned to achieve the individual energy security objectives.

Table 23: Planned policy measures on energy security.

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M1	**New interconnections with neighbouring electricity transmission systems and upgrade of existing ones.**	**PP4.1, PP4.2, PP4.4, PP4.5**	Increase of Diversification, Storage and Demand Response Preparedness to deal with limitation or interruption of supply Deployment of domestic energy sources	Electricity	Technical measure
M2	**Arrangements for promoting electricity demand response.**	**PP4.4, PP4.5**	Increase of Diversification, Storage and Demand Response Reduction in Energy Dependency	Electricity	Regulatory measure
M3	**New interconnections with neighbouring natural gas transmission systems and upgrade of existing ones.**	**PP4.1, PP4.2, PP4.4, PP4.5**	Increase of Diversification, Storage and Demand Response Preparedness to deal with limitation or interruption of supply	Natural gas	Technical measure
M4	**Strengthening of natural gas demand management measures.**	**PP4.4, PP4.5**	Increase of Diversification, Storage and Demand Response Preparedness to deal with limitation or interruption of supply	Natural gas	Regulatory measure
M5	**Electricity storage projects and long term gas storage projects.**	**PP4.1, PP4.2, PP4.3, PP4.4, PP4.5**	Increase of Diversification, Storage and Demand Response Preparedness to deal with limitation or interruption of supply	Natural gas	Technical measure
M6	**Interconnections of non-interconnected islands for the reduction of electricity generation from imported fuels and utilisation of local RES capacity in the most cost-effective manner.**	**PP4.3, PP4.4**	Reducing energy dependence and developing domestic energy sources	Electricity	Technical measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M7	**Substitution of imported fuels from RES in transport.**	**PP4.3**	Reducing energy dependence and developing domestic energy sources	RES petroleum products	Regulatory, economic measure
M8	**Substitution of imported fuels from RES in heating/cooling.**	**PP4.3**	Reducing energy dependence and developing domestic energy sources	RES petroleum products	Regulatory, economic measure
M9	**Periodic update of capacity adequacy study by the Independent Power Transmission Operator, implementation of planned measures and introduction of long-term capacity assurance mechanism.**	**PP4.4**	Increase of Diversification, Storage and Demand Response Preparedness to deal with limitation or interruption of supply	Electricity	Regulatory measure
M10	**Maintenance and update of the National Gas Risk Assessment Study (including Regional Studies) whenever required in accordance with Regulation (EU) 2017/1938.**	**PP4.5**	Preparedness to deal with limitation or interruption of supply	Natural gas	Regulatory measure
M11	**Development of Risk Preparedness Plan in the electricity sector**	**PP4.5**	Preparedness to deal with limitation or interruption of supply	Electricity	Regulatory measure
M12	**Implementation and update of Preventive Action Plan and Emergency Plan for natural gas and implementation of planned measures, including solidarity mechanisms.**	**PP4.5**	Preparedness to deal with limitation or interruption of supply	Natural gas	Regulatory measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M13	**Maintenance and update of Emergency Action Plans for the supply of electricity to non-interconnected islands, and implementation of planned measures.**	**PP4.5**	Preparedness to deal with limitation or interruption of supply	Electricity & Gas	Regulatory, technical measure
M14	**Maintenance of committee for management of serious oil and/or oil product supply disruption.**	**PP4.5**	Preparedness to deal with limitation or interruption of supply	Petroleum products	Regulatory measure
M15	**Maintenance and update of measures of the National Electricity Transmission System (emergency imports of electricity, load shedding schemes, Defence Plan, Restoration Plan, etc.).**	**PP4.1, PP4.5**	Preparedness to deal with limitation or interruption of supply	Electricity	Regulatory measure
M16	**Maintenance and update of the regulation on maintenance of emergency oil reserves.**	**PP4.5**	Preparedness to deal with limitation or interruption of supply	Petroleum products	Regulatory measure
M17	**Increase in the penetration of RES for meeting energy targets.**	**PP4.1, PP4.3, PP4.5**	Reduction in Energy Dependency Deployment of domestic energy sources	RES	Regulatory, economic measure
M18	**Optimal use of domestic hydrocarbon extractions.**	**PP4.1, PP4.2, PP4.3**	Reduction in Energy Dependency Deployment of domestic energy sources	Oil products Natural gas	Regulatory measure

3.6 Internal energy market

The policy measures adopted with regard to the reorganisation of the domestic electricity and gas market, the strengthening of interconnection with neighbouring electricity markets and the strengthening of competition in the domestic market contributed to the reduction of energy costs and hence to the strengthening of competitiveness of the Greek economy and to avoid burdening and/or to alleviate electricity and gas consumers. To further reduce energy costs over the period 2021-2030, it is planned both to maintain and improve the most effective existing policy measures and to implement new measures that will decisively contribute to attaining the individual sub-targets.

In particular, the reorganisation of the domestic electricity market and its harmonisation with the corresponding European ones is one of the prerequisites for achieving the NECP’s climate and energy objectives while enhancing the competitiveness of the economy. The European electricity markets are coupled out through interconnections, thereby fostering competition and increasing the overall economic benefits for consumers and businesses.

Therefore, in order to enhance competition and reorganise the electricity market, it should be accompanied by the promotion of the electricity transmission and distribution networks, including their digitisation and streamlining to enable the new market to function more effectively, involving consumers in the domestic electricity market and the supply of energy packages by suppliers.

Digitisation will enable the dynamic pricing of energy supply and demand through the processing and exploitation of data (demand, meteorology, etc.).

Moreover, the Greek State must address the particularly acute problem of electricity theft, by adopting policies that will motivate operators to identify these cases for the benefit of the community as a whole.

Along with the measures to boost competition and restructure the domestic energy market, measures should be taken to protect consumers and address energy poverty. In particular, targeted measures should be taken to support and empower the residents of areas where lignite units are currently installed, which in the near future will be withdrawn, units that have for many decades provided jobs and high growth rates in those areas.

These policy measures aim to meet the following nine policy priorities (PP5.1-PP5.9) for the period 2021-2030 (Figure 8).

PP5.1: Strengthening electricity and gas interconnectivity with neighbouring countries

PP5.2: Promoting electricity transmission, distribution and storage projects

PP5.3: Promoting gas transmission, distribution and storage infrastructure projects

PP5.4: Digitisation of energy networks

PP5.5: Strengthening competition in electricity and gas markets

PP5.6: Measures for the development of electricity and gas networks

PP5.7: Adjustable charges based on cost-effective incentive mechanisms

PP5.8: Integrated development plans, investment actions and financing programs for lignite-producing areas undergoing a transition

PP5.9: Protecting consumers and addressing energy poverty

Figure 8: Policy priorities for reforming the energy market between 2021 and 2030.

The policy measures that have been specified in the above policy priorities are analysed separately in the following sections.

3.6.1 Boosting interconnectivity

3.6.1.1 Policies and measures to achieve the interconnectivity target

Existing electricity interconnections with neighbouring countries have made it possible, by increasing imports, to reduce the cost of electricity to relieve domestic consumers and boost business competitiveness.

As RES-generated electricity increases its share in the energy mix, the contribution of interconnections to the management of the variable flows associated with these sources to avoid a reduction in clean energy quantities will be very significant. Managing the congestion of interconnections through the markets envisaged in the target model will contribute to price convergence in the European electricity market as well as to the harmonious increase in the penetration of uncontrolled RES plants in the System.

Measures to continue building new interconnectors and strengthen the existing ones is a key priority, while promoting policies that will encourage the construction of new power plants. Examples include the completion of the new interconnecting line between Greece and Bulgaria (Maritsa - Nea Santa), as well as exploring the strengthening of interconnections between Greece and the Republic of North Macedonia and between Greece and Turkey. Moreover, the completion of the interconnection with Crete supports the prospect of the interconnection of Greece with Cyprus and, through Cyprus, with Israel. Finally, it is proposed to investigate the possibility of improving the reliability of existing interconnections.

To ensure the efficient allocation of interconnection capacity in a secure way, it is important to assess it using a common coordinated methodology to take into account the status of the networks, changing flows from RES and price volatility at regional level.

The forthcoming operation of the Regional Security Coordinator (RSC) based in Thessaloniki, which is jointly established by the System Administrators of Greece, Bulgaria and Romania, is a very positive development within the aforementioned framework. Promoting the acceptance of the European legal framework by third countries such as those participating in the Energy Community and their participation in the RSC is necessary to extend harmonised management of interconnections and achieve interconnectivity objectives.

It is critical to address early public acceptance problems in the construction of new interconnectors. Early involvement of local communities as provided for in the Ten-Year Network Development Plan (TYNDP) guidelines should also be pursued.

The implementation of cross-border gas transmission projects and storage systems will significantly enhance the country’s energy role in the wider region of South-Eastern Europe as an energy hub. In the design phase, there are many energy infrastructure projects of direct interest to Greece, such as:

- The East Med pipeline.
- The Turkey-Greece-Italy Interconnection (ITGI).
- The Interconnector Greece-Bulgaria (IGB).
- The Greece - Republic of North Macedonia vertical interconnection.

3.6.1.2 Regional cooperation in this area

Within the framework of international links, regional cooperations have already been launched with the following countries:

Albania	Cyprus
Bulgaria	Republic of North Macedonia
Israel	Turkey
Italy	

3.6.1.3 Financing of measures in this area at national level, inter alia with EU support and the use of EU funds

The key financial instruments include:

- Domestic resources
- Projects of Common Interest (PCIs)

3.6.2 Transmission, power distribution and storage systems

3.6.2.1 Policies and measures to achieve key infrastructure objectives

The promotion of natural gas in the Greek territory is a key priority as it will help reduce energy costs for consumers, while the implementation of cross-border gas transport and storage projects requires the reinforcement of gas distribution, transportation and storage projects. In order to achieve this goal, the completion of the gas transport and storage projects under implementation or planning, as well as the expansion of the distribution network in the Greek territory, will be initiated by significantly strengthening consumers and businesses active in the areas where it expands, by means of reducing their energy costs.

Moreover, the Development Plan of the National Natural Gas System (NNGS), drawn up by DESFA for the period 2020-2029, sets out and proposes, among others, the following NNGS development projects:

- Compression station at Kipi.
- The Metering/Regulation station at Komotini.
- The Compression station at Ambelia.

- Upgrading of the Compression Station at N. Mesimvria.
- The Metering/Regulation station at N. Mesimvria for the connection of the NNGS with TAP.
- The Nea Mesimvria-Idomeni/Gevgeli pipeline and Metering/Regulation station.
- The pilot (first) liquefied natural gas tanker loading station.
- The new Small Scale LNG pier at the Revythousa Terminal.

Moreover, a policy measure is the modification of the development of the transmission system and the electricity distribution network, with the aim of expanding and upgrading it, in addition to meeting the needs of consumers, so that new RES plants can be installed to promote the penetration of RES electricity generation to the country's energy mix, and to boost competition in the wholesale electricity market.

In proportion to the gas market today, many energy infrastructure projects of direct Greek interest are being developed, such as interconnection projects with the neighbouring countries described above and interconnection projects of the Non-Interconnected Islands with the HETS by ADMIE. The interconnection of the majority of Greek non-interconnected islands with the mainland electrical system, besides reducing the cost the electricity generation cost and, therefore, restricting the regulated charges imposed on the electricity bills of all customers through the public utilities, will help limit pollutants emitted and reduce energy dependency on other countries due to the limited use of oil products.

Steps are also taken to promote the installation of electricity storage systems that will help to increase RES penetration and reduce electricity costs, while also enabling Electricity Producers to provide competing electricity packages to suppliers, and thus to electricity consumers, along with the other units they may have in their portfolio.

In addition to the above, there is a need to completely digitise networks and meters management to reorganise the electricity and gas markets and enhance competition. In particular, it is necessary to take measures to install digital, 'smart' meters and to install centralised systems for the control and management of the operators' property. The centralised control systems of the operators should communicate with the network components via a telecommunication link.

Digitising energy networks

As part of the energy transition to a pollutant-free energy system, increased control requirements are being created so that the production of changing RES be at all times in line with demand, while the role of system and electricity distribution operators becomes ever greater complex. In this regard, digitisation of networks is expected to play a particularly important role, contributing to the optimal control of the system.

Visibility between system and distribution operators should be increased to achieve a coordinated management of (a) system and network congestion and (b) the use of balancing resources through the use of shared platforms.

Consumers' role is now being upgraded, enabling them to provide power to the grid from small-scale RES plants as well as flexibility services through demand response schemes or smart charging for electric vehicles. In the future, it will be possible to carry out transactions directly, without the mediation of a third party, through the direct exchange of data between the parties concerned. This is enabled through innovative information systems, digital applications and decentralisation technologies such as blockchain, which enable innovative decentralised energy and flexibility markets to operate in real time and to perform secure electricity transactions between end-users and small-scale producers.

However, an additional risk factor is created as digitisation of all data moved, on the one hand, increases the complexity of the system dramatically and, on the other hand, makes the system more vulnerable to cyberattacks. It is therefore necessary to certify the equipment and communication protocols used to minimise the exposure of the system to possible cyberattacks.

In turn, institutions at national and European level must ensure the necessary regulatory framework so that all required communications are secure. In this regard, the European Commission is currently reviewing the EU's cyber security strategy, and has already issued a recommendation on cyber security in the energy sector.

3.6.2.2 Regional cooperation in the field of gas transmission infrastructure

Within the framework of international links, regional cooperations have already been launched with the following countries:

Albania	Cyprus
Bulgaria	Republic of North Macedonia
Israel	Turkey
Italy	

3.6.2.3 Financing of measures in the field of gas transmission infrastructure at national level, inter alia with EU support and the use of EU funds

The key financial instruments include:

- Domestic resources
- Projects of Common Interest (PCIs)

3.6.3 Market consolidation

3.6.3.1 Policies and measures to achieve the relevant objectives

The reduction in energy costs is expected to result from the strengthening of competition both in the electricity sector and in the supply of electricity and gas.

Indicatively, a package of measures to boost competition in the wholesale electricity market, as well as the adoption of mechanisms, where necessary, to ensure the viability of the electricity generation units and the continental system power adequacy, will be explored in the period 2021-2030.

Meanwhile, the existing NOME mechanism has been abolished and an ***organised Greek energy market for financial products is being created,*** which will be launched in the first quarter of next year in order to achieve a smooth transition to the new market framework and not to slow down the steps to foster competition.

Additional policy measures will be implemented to strengthen competition and reduce energy costs, such as the launch of the four markets envisaged in the Target Model and the coupling of the Greek electricity market with neighbouring markets.

In the context of measures to reform the domestic electricity market and strengthen competition, measures will be promoted to increase participation of demand and, in general, of consumers in the electricity market, thereby enabling consumers to influence electricity prices.

At the same time, and in line with the Gas Market Roadmap 2017-2022, similar measures will be adopted in the gas sector such as the maintenance of gas releases and the implementation of policy measures for the reform of the retail and wholesale natural gas markets proportionately to the structure and operation of the reformed electricity market.

In addition, according to the 2017-2022 Natural Gas Market Roadmap, in addition to increasing the use of natural gas in heating uses (mainly residential and commercial) through the expansion of the existing distribution network, the construction of a new distribution network in new geographic areas and the development of compressed and liquefied natural gas infrastructures, it is planned to design and implement important infrastructure projects of national and international interest with a view to strengthening and expanding of natural gas systems in the South-eastern Europe and the Eastern Mediterranean region.

Finally, the Hellenic Energy Exchange in cooperation with the Ministry of the Environment and Energy, RAE and DESFA and with the support of a consulting firm, are finalising the plan to implement a gas trading platform for the Greek market. The implementation plan will outline the critical aspects of the venture of creating and developing a trading platform in line with the requirements of the European Balancing Regulation. All legal, regulatory, technical, operational and financial aspects are under consideration, with the aim of ensuring that negotiations on the spot market will be possible by the year 2021, and it is hoped that derivative products will soon follow. The gas trading platform to be operated and managed by the Hellenic Energy Exchange, combined with the development of infrastructure and interconnections, will practically make Greece the basis of a regional gas hub.

Schedule of operation of the new electricity market model

The Greek government has set development and full operation of the new electricity market model by early June 2020 as a top priority in the energy sector for the near future.

A key prerequisite for the transition of the Greek electricity market system to a unified European market, in accordance with the European legislation for the completion of the single electricity market and the achievement of the Target Model, is the coupling of our Markets with other European markets, first with Italy and Bulgaria and then with countries outside the EU, as long as they bring their legislation in line. In this regard, the launch of the go-live coupling for the Greek-Italian border and the addition of the Greek-Bulgarian border to the above IBWT project has already been approved by the Italian Borders Working Table Steering Committee (IBWT).

Meanwhile, all the necessary laws and regulations have been put in place so that the relevant Operations continuously monitor and adhere to the relevant schedules, as well as to strengthen RAE's powers to control and monitor the Greek energy market and to impose sanctions on the Greek authorities in cases of breach of EU and national law.

Furthermore, provision is made to develop the necessary mechanisms and to adopt appropriate regulatory measures to protect consumers and to create fair competition conditions. Finally, measures are being taken to foster competition in the electricity market, such as the operation of the Energy Financial Market under Law 4425/2016, as applicable, in which, initially, it will be possible to negotiate futures contracts with a cash settlement and subsequently with a right of physical delivery, which are an essential tool for hedging financial risk. Forward trading is also expected to enhance long-term system design activities such as investment in production, transportation, distribution and demand management, indicating future expectations concerning market hourly prices and providing reliable financial signs to Participants.

3.6.3.2 Measures to increase the flexibility of the energy system

Greece is promoting measures to enhance the flexibility of the energy system through the involvement of demand in the market, further development of interconnections, integration of flexible units in the electricity system, as well as the provision of incentives for the deployment of storage systems.

At the same time, the possibility of establishing Aggregators and Energy Communities has been instituted, enabling electricity consumers to operate in the electricity market, either as consumers or as producers, and through dynamic electricity tariffs, to restrict both the electricity costs of the System and the costs for consumers involved in these bodies.

Demand participation in the electricity market will be made possible and strengthened through the installation of 'smart' meters for all electricity consumers, a project expected to be completed in the following decade. This will allow to send orders to grid users remotely, so that they change their load curve, to reduce electricity prices and to participate in ensuring the power adequacy of the electricity system.

New technologies will make it possible to decentralise generation and to balance generation and demand locally.

3.6.3.3 Measures to ensure the inclusive participation of renewable energy, demand response and storage

As mentioned above, the Greek State has already taken measures to promote the participation of demand in the electricity market, both through by instituting Aggregators as well as the ability for consumers to participate in Energy Communities.

Law 4414/2016 also stipulated that all new power plants would have to participate, above a certain power limit, in the electricity market by submitting an appropriate, priced supply-forecast either on their own or through the Aggregators. If they submit an incorrect forecast, RES plants will be charged with the corresponding charges-fines.

In addition, the full regulatory framework for the operation of storage systems in the electricity market will have been developed and it will be possible to develop these systems as part of generation units with simplified administrative procedures to authorise their operation by 2020.

Already in the energy offsetting scheme, provision is made to operate storage systems exclusively for the storage of energy generated by self-generation RES systems and for its use by end consumers to meet their electricity needs at a later time.

3.6.3.4 Policies and measures to improve the performance of operators by applying regulated charges based on cost-effective incentive mechanisms

Losses of electricity in electricity transmission and distribution networks are now burdening electricity providers and therefore consumers. Therefore, the introduction of policy measures to mitigate these losses through the application of regulated charges on the basis of cost-effective incentives and achievement of objectives will lead operators to step up their efforts to reduce these losses, and this methodology could also include specific innovative development activities contributing to national targets and the achievement of comparable indicators regarding the timing of the integration of RES units into the networks. Generally, operators can benefit from positive performance incentives in their areas of activity in line with best practices at European level.

3.6.3.5 Measures to develop electricity and natural gas networks

To date, domestic electricity transmission and distribution networks have been developed with the aim of linking the urban centres with the decentralised conventional electricity generation plants, while gas networks have respectively been developed to supply gas as an alternative energy source.

However, even in the context of energy transition, structural changes in the design of network development projects are now required. In particular, the increased penetration of RES both at the transmission and distribution level, ensuring their connection and unhindered operation, the transition of Member States' energy markets to a single market presupposes the development of a trans-European energy network with sufficient interconnectivity to electricity and gas networks, diversification of sources and suppliers from third countries to enhance security of supply, as well as expansion of the use of gas to final consumption and distribution throughout the country, are setting new challenges and parameters that should be taken into account in the development planning of energy networks.

To this end, energy network operators should adapt and update their development plans, taking into account the following axes:

- Flexibility - smart energy management systems and technologies
- Accessibility - equal access for all users on the network
- Security - access to different energy sources to enhance the security of energy supply
- Sustainable economy - networks should be developed and managed on an equal, fair and transparent playing field for the benefit of consumers

Although the country has fully complied with EU Directives and has split the ownership of electricity and gas transmission networks, it is a strategic goal of the Greek Government to further liberalise and accelerate the development and management of domestic energy transmission and distribution networks, in line with the new market demands.

To this end, the Greek Government has developed an ambitious privatisation programme as a means of creating a framework for impartial, transparent and fair competition, attracting new long-term strategic investors and leveraging new private capital. The programme aims at mobilising and accelerating new strategic investments in the development, upgrading and digitisation of networks in order to enhance the quality of services provided and to create the conditions for the development of new value-added combination products for the benefit of consumers.

Finally, this policy of the Greek Government is expected to strengthen and upgrade RAE’s role as the authority responsible for overseeing the proper development and operation of electricity and gas networks.

3.6.3.6 Integrated development plans, investment actions and financing programmes for lignite areas undergoing a transition

Phase-out of lignite in the areas whose economy is heavily dependent on lignite mining makes it imperative to address the direct and indirect impacts on these areas (detailed presentation in PP1.1). As a result of the restructuring of the energy mix and the deregulation of power generation, an integrated action plan is planned to be fully implemented before the start of the transition period, which will lead to the creation of new business opportunities through a new economic model in order to offset the surge in job dismissals due to the closure of lignite production plants.

For this reason, and under the auspices of an inter-ministerial committee, a comprehensive, multi-dimensional and forward-looking Fair Transition Development Plan will be prepared and presented by mid-2020, which will include a set of measures and forecasts reflecting the transition strategy for lignite areas.

The above strategy will be put into practice by planning and implementing a ***Special Transition Development Plan for the post-lignite era***.

The key objective is to create a ‘new future’ for these areas, with a restored natural environment, quality of life, a diversified production model and entrepreneurship as a dominant choice.

3.6.3.7 Policies and measures to protect consumers and improve competition

Consumer policy measures will include, among other things, adoption of a regulatory framework for the protection of electricity consumers from high electricity market prices on the wholesale market.

Moreover, strengthening the necessary control mechanisms to ensure the transparent and lawful operation of the oil market and to safeguard consumer protection is a priority. At the same time, in order to enhance the penetration of alternative fuels and electrification, aid for stations is planned so that they are modernised and so that they supply consumers with the whole set of alternative fuels.

3.6.4 Energy poverty

3.6.4.1 Policies and measures to achieve the relevant objectives

With regard to combating the phenomenon of energy poverty, the improvement of the existing measures of the social tariff and the status of the Universal Service will be launched, involving only energy-vulnerable households.

At the same time, consideration will be given to the possibility of introducing the ‘energy card’ as a support measure for vulnerable electricity consumers, which will replace the other support measures for the consumption of energy goods and which will enable consumers to select themselves the way in which they will have their energy needs met.

Targeted financing programmes will be designed to improve the energy efficiency of residential buildings of households that are vulnerable with regard to energy. In addition, incentives will be explored for both energy suppliers under the energy efficiency obligation scheme and for energy communities, so that they contribute more actively to the energy upgrading of such buildings.

Addressing energy poverty

Addressing energy poverty is a major challenge by 2030 to reverse the effects of this phenomenon, which have been exacerbated by the economic downturn.

Achieving this goal requires the design and implementation of a coherent and effective strategy, which will aim to permanently and radically combat the phenomenon rather than its temporary mitigation through temporary and short-term measures.

This strategy will be specified and outlined in the Energy Poverty Action Plan, which will be completed in the first half of 2020.

The action plan will include both the definition of households experiencing energy poverty through specific quantitative criteria, as well as a specific process to monitor and evaluate the evolution of the phenomenon. In addition, specific policy measures will be specified, in accordance with the requirements of both Directive 944/2019 and Directive 2002/2018, and a specific process will be developed to monitor and measure the impact of each measure separately, in order either to redesign them or to adopt new policy measures.

3.6.5 Fossil fuel subsidies

The Commission's most recent sustainable energy package makes it clear that technologies that are phased out or may not be viable in the long run should not be supported by public funding. Despite the challenges associated with the transition, our country is making progress in reforming its subsidies for fossil fuels across a wide range of sectors.

This effort is supported by the change in the country's energy model, which makes provision for greater participation of RES in the energy mix, phase-out of lignite-fired power plants, electrical interconnection of NIIs, electrification of end consumption, improvement of energy performance and energy savings in the end sectors.

However, in the context of social policy, general aid policies for the cost of supplying energy products, based on specific income and property criteria, such as the Social Domestic Tariff (SDT), the reconnection programme, the allowance scheme for the purchase of heating oil, which is in place for the year 2019-2020, as well as for the cost of electricity in non-interconnected islands, are also implemented.

In the electricity sector, it is obvious that the above social policy through energy products will no longer constitute an indirect subsidy to fossil fuels in the short to medium term, as the mix of electricity generation is changing rapidly and there is a constant increase in RES participation, amounting to over 65% of domestic electricity generation and given the interconnection of almost all islands by 2029 and the development of hybrid power stations in the rest. In addition, the increase in electricity tariffs acts in competition to the allowance for the purchase of heating oil and/or options to meet the thermal needs using combustion of carbon and inappropriate materials (plastics), which had dramatically burdened the atmosphere of the big cities and caused fatalities in the past.

Through the energy product tariffs, the above social policies will be reviewed in accordance with the relevant Directive, and specific action plans will be provided in the Action Plan to combat energy poverty.

In the context of social policy, consumer protection and the fight against energy poverty, the government's choice is to apply the principles of empowerment and sustainability, providing support to all vulnerable groups facing the risk of poverty and/or social exclusion through long-term and sustainable solutions.

This also includes measures to promote the renovation of buildings through programmes providing specific categories of subsidies for the economically weaker population groups, and self-generation programmes that are expected to contribute to this and also to reduce the need to strengthen citizens through energy product tariffs.

3.6.6 Summary of policy measures

Table 24 summarises the policy measures envisaged to achieve individual objectives as part of the internal energy market dimension.

Table 24: Planned policy measures for the internal energy market.

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M1	**Reinforcement of electricity interconnections with neighbouring countries.**	**PP5.1, PP5.9**	Electricity interconnectivity Energy transmission infrastructure Energy market integration Adequacy of electrical system Flexibility of energy system Consumer protection Improvement of competition Energy poverty	Electricity	Technical measure
M2	**Cost Benefit Analysis (CBA) of planned investments**	**PP5.1, PP5.2, PP5.3, PP5.4**	Electricity interconnectivity Energy transmission infrastructure Energy market integration Adequacy of electrical system	Electricity	Technical measure
M3	**Development of interconnections of non-interconnected islands to the mainland system.**	**PP5.2, PP5.9**	Electricity interconnectivity Energy transmission infrastructure Energy market integration Adequacy of electrical system Flexibility of energy system Consumer protection	Electricity	Technical measure
M4	**Support of international natural gas transmission projects.**	**PP5.1, PP5.9**	Gas interconnection Energy transmission infrastructure Energy market integration Adequacy of electrical system Flexibility of energy system Consumer protection Improvement of competition Energy poverty	Electricity Natural gas	Technical measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M5	**Support of electricity and gas storage projects.**	**PP5.3, PP5.6, PP5.7, PP5.9**	Electricity interconnectivity Energy transmission infrastructure Energy market integration Adequacy of electrical system Flexibility of energy system Consumer protection Improvement of competition	Electricity & Gas	Technical measure
M6	**Support of projects for extension of the distribution network.**	**PP5.2, PP5.6, PP5.3, PP5.7, PP5.9**	Electricity interconnectivity Energy transmission and distribution infrastructure Adequacy of electrical system Flexibility of energy system Consumer protection Energy poverty	Electricity & Gas	Technical measure
M7	**Adoption of a long-term capacity adequacy mechanism.**	**PP5.2, PP5.9**	Adequacy of electrical system Consumer protection	Electricity	Regulatory measure
M8	**Continuation of the implementation of reforms for reshuffling the electricity market and of the implementation of the Target Model.**	**PP5.5, PP5.9**	Energy market integration Consumer protection Improvement of competition	Electricity	Regulatory measure
M9	**Continuation of the adoption of measures for coupling the electricity market with the markets of the neighbouring countries.**	**PP5.4, PP5.5, PP5.9**	Energy market integration Consumer protection Improvement of competition	Electricity	Regulatory measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M10	**Adoption of measures for strengthening demand response and for the participation of demand in the wholesale electricity market.**	**PP5.4, PP5.5, PP5.9**	Consumer protection Improvement of competition	Electricity	Regulatory, technical measure
M11	**Maintenance of mechanism for the disposal of natural gas quantities through electronic auctions (gas release).**	**PP5.5, PP5.9**	Consumer protection Improvement of competition	Electricity & Gas	Regulatory measure
M12	**Continuation of measures/policies for reforming the retail and wholesale natural gas market.**	**PP5.5, PP5.9**	Consumer protection Improvement of competition	Electricity & Gas	Regulatory measure
M13	**Maintenance of social tariff scheme.**	**PP5.9**	Energy poverty Consumer protection	Residential sector	Economic measure
M14	**Adoption of measures for protecting consumers from high electricity market prices on the wholesale market**	**PP5.9**	Consumer protection	All sectors of final energy consumption	Regulatory measure
M15	**Provision for the automatic transition of vulnerable domestic customers into the Universal Service scheme.**	**PP5.9**	Energy poverty	Residential sector	Regulatory measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M16	**Exploration of the introduction of the ‘energy card’.**	**PP5.9**	Energy poverty	Residential sector	Economic measure
M17	**Energy upgrade of residential buildings of households that are vulnerable with regard to energy and promotion of the installation of RES plants for the purpose of meeting their energy needs**	**PP5.9**	Energy poverty	Residential sector	Economic measure
M18	**Motivation of existing mechanisms for actions in vulnerable households**	**PP5.9**	Energy poverty	Residential sector	Economic measure
M19	**Strengthening the necessary control mechanisms to ensure transparency of the oil market.**	**PP5.5, PP5.9**	Consumer protection Improvement of competition	All sectors of final energy consumption	Regulatory measure
M20	**Programmes for lignite areas undergoing a transition**	**PP5.8**	Smooth transition of lignite areas	All final consumption sectors consumption	Economic measure

3.7 Energy transition policies in the agricultural, shipping and tourism sectors

Making the most of the potential for emission reductions, promoting RES and improving energy efficiency in specific sectors of the Greek economy, such as agriculture, shipping and tourism, are also a priority for the period 2021-2030.

In particular, seven policy priorities in these new areas (PPN.1-PPN.7) are integrated with a view to making the most of the existing potential (Figure 9).

PPN.1: Promoting infrastructure for the use of natural gas

PPN.2: Handling and utilising agricultural and livestock residues

PPN.3: Promoting the use of RES and energy efficiency improvement actions in ports

PPN.4: Developing domestic production of advanced biofuels and supply chains for their use

PPN.5: Promoting the use of RES and energy efficiency improvement actions in the agricultural sector

PPN.6: Sustainable tourism development and destination management plans

PPN.7: Promoting the use of RES and energy efficiency actions in tourist complexes

Figure 9: Policy priorities in the field of agriculture, shipping and tourism for the period 2021-2030.

The policy measures that have been specified in the above policy priorities are analysed separately in the following sections.

3.7.1 Policies and measures in the agricultural sector

The basic principles of the agricultural sector in line with the Greek Rural Development Programme adopted by the European Commission for the period (2014-2020) include, in particular, enhancing the viability and competitiveness of agricultural holdings, maintaining and enhancing ecosystems and promoting local development in agricultural areas. The country's agricultural development priorities can also be achieved through complementary sectoral policies by increasing its added value, such as the contribution of energy products.

As a result, a policy package is needed to harness the potential of the agricultural sector to reduce greenhouse gas emissions, promote RES and improve energy efficiency.

The use of biomass for energy generation in Greece is limited in relation to the availability of residual biomass. The following measures are proposed to promote biomass for energy production:

I. **Priority in the use of waste (agri-livestock units and industries, urban):** To promote the use of energy from biomass, with a focus on new technologies, it is necessary to take into account the availability of biomass in Greece in terms of the availability of agricultural/forestry residues and waste from the industries concerned, as well as the biodegradable fraction of urban waste and sewage, in relation to the principles of the Circular Economy and the relevant legislation on waste, so as not to distort the competitive markets of biomass (food, feed, materials). Priority should be given to avoiding or reducing waste (agricultural/forestry, livestock, urban), to waste recycling and use for heat/electricity generation, as well as advanced biofuels for transport. Bioenergy support systems, which would run counter to waste treatment targets and would lead to inefficient use of recyclable waste, should be avoided.

II. **Supply chain organisation and land planning of sites for temporary storage of agricultural/forest residual biomass**: The organisation of the supply chain from the collection of residual raw materials in the primary sector, its processing and conversion into the secondary sector, the heat and power distribution networks to engineers, supervisors, technicians, plant maintainers, requires supportive measures because it involves high costs that may inhibit the sustainability of future investments in the production of bioenergy and biofuels or bioliquids. These measures should also include support for the development of infrastructure for the temporary storage, pretreatment and storage of residual biomass within private premises/plots and/or central collection points (biomass management centres), which will help to address the inappropriate practice of open burning sites observed in the countryside. Managing centres may be either private or public (e.g. municipal or regional) and their existence will generally make it easier to access biomass and exploit it through the activities of circular economy.

III. **Maintenance and extension of the sustainability certification scheme for biofuels, bioliquids and solid fuels** to ensure that only sustainable biofuels, bioliquids and solid fuels are used in the Greek territory.

IV. **Sustainable forest management**: Rational logging of forests, update of forest management studies kept in the country's Forestry Offices and planning of a sustainable cycle of periodic logging operations with specific requirements and conditions. Enhancing the role of energy communities and cooperatives in cleaning up forests to protect them against fires in accordance with specific technical specifications and utilising the woody biomass removed for energy purposes. In addition, a LULUCF strategy will be explored with a view to increasing afforestation and, thus, to maximise the absorption contribution to the transition to a future of climate neutrality.

V. **Strengthening the primary sector through the promotion of energy crops of woody biomass or coppice plantations:** In addition to the utilisation of agri-livestock waste and agricultural/forest residues, the primary sector could also contribute to the production of biomass (solid biofuels) from the cultivation of short-rotation forest species and other perennial plants (e.g. reed). These energy crops will provide additional jobs in the region, and will also increase the availability of biomass to minimise the need for imported biomass. Relevant support measures are to support such investments through specific reference to financing programmes (NSRF, Rural Development, etc.), to simplify the process of implementing such crops by either natural or legal persons, and land planning in regions throughout Greece where it will be possible to cultivate such crops (degraded soils, nitrified soils, quarries after mining etc.) so that their development will not compete with other markets (food, feed, materials).

VI. **Creation and enhancement of the domestic bioethanol market**, by enhancing conventional bioethanol (i.e. bioethanol derived from the processing of agricultural food items such as corn, wheat, beet, etc. according to the applicable sustainability criteria), and above all provision of support to the advanced production of bioethanol from the use of residual forms of biomass and waste as well as non-food crops. Relevant support measures concern bioethanol or bioethers blending with conventional transport gasoline, and also a provision to introduce cellular (advanced) bioethanol with specific low blending rates.

VII. **Development of the biomethane market**, both for its injection into the natural gas network and its use as a transport fuel. In order to achieve this goal, a specific licensing process should be instituted in order to allow for the earliest possible implementation of bio-methane production plants, with the aim of achieving the greatest possible substitution of natural gas from domestically produced and renewable biomethane. As biomethane is produced using low-cost materials and organic waste for the purpose of producing high-value gas fuel, this priority will contribute to more efficient waste management.

The revised Common Agricultural Policy (CAP) introduces specific measures in the context of Green Direct Aid to reduce greenhouse gas emissions by promoting sustainable food production, sustainable farm management and environmentally and climate-friendly practices and methods. The measures that will be implemented aim at preventing desertification, improving water management, reducing the intensity of natural resources, optimising the use of agricultural land, reducing the use of fertilisers and improving animal waste management. The promotion and increase of organic farming is also a key priority of the next Rural Development Programme, contributing to the reduction of greenhouse gas emissions.

Specific policy measures will be launched to harness the high potential for installing RES plants and systems in the agricultural sector. In particular, measures will be designed to install mainly photovoltaic systems through the energy offsetting and virtual energy offsetting scheme in both agricultural and livestock holdings and pumping stations.

In addition, RES installation on high productivity land will be launched taking into account the provisions of the licensing and spatial planning framework to ensure that energy production does not compete with the economic activities of the agricultural and livestock sector.

RES systems for heating and cooling on agricultural and livestock holdings will be promoted, as an indication of the utilisation of geothermal energy and other forms of RES in greenhouses.

Finally, the consumption of biofuels will be enhanced both in machinery used in agricultural and livestock holdings and in other activities.

In terms of energy efficiency improvement, measures will be promoted to replace existing machinery and installations used in both agricultural and livestock holdings with new high energy-efficient ones. Priority will be given to high energy-consuming machinery and equipment, such as tractors, mowers and harvesters, cotton pickers and seeders on farms and milking machines, poultry incubators, cleaning machines and feeding troughs in livestock holdings.

Emphasis will be placed on pumping stations and crop irrigation systems by designing measures that will both reduce energy consumption and save water. Energy efficient equipment will be promoted for the main systems used such as pumps, artificial rain assemblies, self-propelled launchers, drip irrigation systems and self-propelled artificial rain assemblies.

In addition, energy-efficient heating, cooling, ventilation and lighting systems will be introduced into agricultural and livestock holdings, including greenhouses. For the production of thermal and cooling energy in particular, this objective will be achieved by both individual and central systems. In this regard, the potential of installing district heating and micro-cogeneration systems will be explored.

Other actions to be launched include installation of control systems, thermal insulation of buildings and heat recovery from various processes using alternators.

Finally, priority will be given to informing and educating practitioners on energy saving practices to be adopted through specific tools such as developing targeted energy checks and updating certification and energy labelling schemes.

3.7.2 Policies and measures in shipping

3.7.2.1 Promoting infrastructure for the use of natural gas in shipping

During the last two decades, the mix of the international energy map and, by extension, in Europe, also includes RES, as well as goals of energy efficiency in the wider context of States' commitments, as originally emerged from the Framework Convention on Climate Change, international contracts as well as European directives. In particular, with respect to the shipping sector, Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL 1973/78) by the International Maritime Organization (IMO) introduces the obligation to apply worldwide a new maximum limit for sulphur content of marine fuels as of 1 January 2020, and there stricter restrictions are put in place in designated specific emission control areas (e.g. Baltic and North Sea). Meanwhile, Annex VI of the International Convention MARPOL 1973/78 sets out a complete set of rules, within the IMO, for the control of other harmful emissions from ships (NOx, ODS, VOC combustion), with a view to tackling global air pollution and protecting the environment and human health.

In line of its Initial Strategy adopted in 2018, the International Maritime Organization is considering potential short-, medium- and long-term measures to reduce greenhouse gas emissions from ships, of which the first category (short-term measures) will be adopted by 2023. IMO's objective is to accelerate the development of low-emission and zero-carbon technologies necessary to achieve emission reduction levels for 2050, in line with the IMO's long-term binding objective and its above mentioned Initial Strategy. Seagoing shipping, due to its global operation in the context of free international competition, will be governed by IMO global measures, applicable worldwide and irrespective of the flag of the ship.

As for sulphur, its ceiling on international shipping fuels will be reduced to 0.5% from 1.1.2020 as opposed to the current rate of 1.5% (for liners) or 3.5% (for other ships), while for the special ship emission control areas the applicable 0.10% ceiling already applies from 1.1.2015. At present, for some shipping sectors such as liners operating on short sea shipping and ferries, a reliable option among the alternative fuels is bunkering using liquefied natural gas, because it offers environmental benefits, on the one hand, and fuel cost savings, on the other. In particular, liquefied natural gas provides 20-25% lower CO2 emissions, 90% for NOx and 99% for sulphur oxides (SOx) and microparticles, compared to marine fuel oil. Studies show that there is a greater growth in available facilities for liquefied natural gas bunkering of ships in Northern Europe (as opposed to the Mediterranean). In actual figures, some 170 ships worldwide are already using liquefied natural gas as fuel, and even more have being ordered, which leads many ports, mainly Asian, already to develop liquefied natural gas refuelling infrastructure.

However, LNG is not considered a long-term viable solution for seagoing shipping. EU and national legislation has included arrangements for the development and implementation of alternative fuel infrastructure, and for the safe bunkering of ships. Promoting the use of liquefied natural gas as a marine fuel has been included as a goal in the 'Natural Gas Market Roadmap 2017-2022', which is an approved decision of the Government's Economic Policy Council.

In addition, Greece participates in the European programme Poseidon Med II, together with Italy and Cyprus, which aims to introduce liquefied natural gas into the shipping industry as primary fuel, as well as to develop a bunkering infrastructure network. In a first stage, it is envisaged to create relevant infrastructures, initially in the ports of Patras, Heraklion, Igoumenitsa, and then to ensure the supply of liquefied natural gas to ships with either mobile or coastal facilities and other Greek ports of strategic importance for ferry services such as Rhodes and Syros. In the port of Piraeus, which will be the main centre for the supply of liquefied natural gas to ships, no storage facilities are needed and the ships will be refuelled with liquefied natural gas barges and tankers.

For this reason, within the framework of the Poseidon Med II programme, site design studies, security studies, environmental impact studies, economic studies, ship design, process planning etc. are being prepared so that Greece, due to its geographical location, becomes a strategic player in the supply of liquefied natural gas to ships.

However, as the wider adoption of liquefied natural gas as a fuel for shipping will depend on global and European availability of liquefied natural gas supply infrastructure, the price of liquefied natural gas, financing issues and the need for clear regulatory policy, coordinated international/European actions and coordination of all the Ministries involved in the country to immediately promote the actions, are needed to achieve this.

A key action that will contribute to the development of liquefied natural gas is initially the development of the relevant infrastructure. In this context, DESFA has already included in the Ten-Year Development Plan of the National Natural Gas System the construction of a pier at the Revithousa terminal with a budget of EUR 34 million. The project is expected to be completed by the end of 2023 and will involve a port facility for the bunkering of vessels with a capacity of 1 000-20 000 cubic meters of liquefied natural gas.

Moreover, DESFA has also included in the same Development Programme the construction and operation of a facility for the transhipment of liquefied natural gas in tankers, which is expected to become operational by 2021. The two projects provide synergies and help make better use of existing infrastructure.

It is also necessary to adopt or modify the Master Plans for the ports, which will form a central network in Greece and will include the necessary facilities as well as the operation of refuelling ships with liquefied natural gas, initially in ports which are particularly important for ships such as Piraeus / Patra / Igoumenitsa / Heraklion / Thessaloniki / Rhodes / Syros.

An important aspect is the completion of the regulatory framework for the implementation of the above projects, including the development of manuals and rules for the safety of mobile tanks in lorries and ships, as well as in coastal facilities and barges, as well as the participation in training programmes for the construction, support and maintenance of coastal facilities and mobile tanks, barges and lorries. The current regulatory framework consists of the newly adopted Decree 64/2019 (Government Gazette, Series I, No 103, 20.6.2019 - Regulation on the safe bunkering of ships, regardless of flag, with LNG in ports, port facilities and territorial waters of the Greek territory, from bunkering facilities, bunkering vessels, etc.), that is in force since 20 July 2019.

Proposed actions for the following period are:

- Prioritising the construction of a small-scale LNG pier at Revithoussa Terminal
- Implementing a small or medium-scale coastal liquefied natural gas port infrastructure, based on the volume of bunkering capacity, at central coastal shipping ports and the ports of Piraeus and Patras as ports of departure, through the use of financial instruments.
- Promoting the production of small-scale liquefied natural gas (LNG) facilities by Greek industries and shipyards (storage tanks, transport tanks, etc.).
- Investigating the possibility for Greek shipyards to construct liquefied natural gas ships and barges by introducing financial instruments and providing incentives (financial, tax etc.).
- Adopting deductions on docking costs and fees for ships using liquefied natural gas as fuel.

- Imposition of strict environmental standards and financial/tax support for the conversion/replacement of ships operating exclusively within the boundaries of ports or between ports offering liquefied natural gas bunkering facilities (e.g. tugs, general and special cargo vessels, urban sea transport).
- Promoting education and training actions for human resources involved in port adaptation actions and policies for LNG use

Finally, there is a need to further strengthen research in order to find other environmentally and economically viable solutions. Hydrogen is a future solution, although it is currently at an early stage of development. It is noted that Greece has a significant track record in scientific investigation and research in the field of hydrogen production from RES.

It is considered important for the country's scientific potential to monitor and participate in relevant programmes promoting hydrogen as a fuel in shipping, in the more specifically targeted areas applications where this is appropriate (e.g. barges in terminals or hydrogen-powered ferry boats with an electric motor). A typical example is the initiative developed by the Norwegian authorities, with the ultimate aim of building and operating a hydrogen-powered ferry boat with an electric motor or converting an existing oil-powered ship to hydrogen-powered, as well as the use of barges at Dutch terminals).

However, the application of hydrogen is not attractive to seagoing vessels as it involves a significant reduction in the useful capacity of ships and is a complex and expensive investment.

The above constitute an area of partnership development for the research community and the support of the domestic maritime industry will be explored.

3.7.2.2 Promoting the use of RES, Electricity and Electrification, and energy efficiency improvement actions in ports

Energy consumption occurring in ports, either because of their internal energy needs or because of the ships moored in them, is particularly important and therefore a component of planning interventions as part of the NECP.

Bearing in mind that the competitive cost of electricity generation from RES now enables the design and integration of local, mainly photovoltaic RES plants into ports to cover both own consumption in the form of self-generation, and the gradual transition to the electrification of some of the ports main consumptions (e.g. electrification of their fleet), as well as ships, either during mooring or inland voyages, policies and measures should be designed and adopted to enable this potential to be harnessed in the optimum technical and economic way.

Many European and international ports have already progressively taken electrification actions and replaced fuels, integrating in many cases local grid-based power generation and management systems to power their operations, including powering ships exclusively with electric power from RES initially for inland voyages. This approach leads to a drastic reduction in emissions of gaseous pollutants, especially NOx, to ports and neighbouring urban areas with immediate visible benefits to public health.

However, in order to implement this port electrification and RES promotion plan, local electricity networks need to be strengthened also at the level of substations, taking into account hourly and peak loads for both demand at ports and demand for specific energy consumptions on ships. There is a need for more specific design to meet the energy consumption needs of cruise ships, whose energy needs in mooring are particularly demanding.

In this context, cost-benefit studies will be developed in the next period, with the co-operation and coordination of the relevant departments of government agencies and port organisations, in order to design specific incentives for investment in RES projects to meet the needs of Greek coastal shipping at ports (such as a special licensing scheme/tax and investment incentives), as well as for the installation of substations and strengthening of networks (tax/investment/securing the possibility financing of part of the project by banking institutions).

Concerning the electrification of ships, pilot applications will initially be supported and the aim is to operate specific voyages by electric ships by 2030, by developing both the appropriate infrastructure and a regulatory framework that will enable the electrification of ships. Where appropriate, consideration should also be given to developing licensing and/or financial incentives for the installation of relevant infrastructures and/or the provision of tax reliefs for the operation of ships making use of the electricity and electrification facilities.

In addition, actions to improve their energy efficiency and to adopt energy management systems will be promoted at the port level, so that overall the intensity of energy activity in relation to their economic activity can be improved and made more efficient.

Another aspect of the issue that needs to be addressed, given the limited ability to provide increased power to the country's ports as described above, is to ensure the provision of electricity to vessels, whatever the demand fluctuation may be.

It is therefore necessary to develop mid-to-long-term viable alternatives that will use new and existing technologies to design infrastructures, both in ports and on the basis of conversion of the mechanical parts of vessels, with a view to ensuring their energy autonomy.

In the medium term, it is proposed to investigate the know-how necessary for the future planning of interventions for the energy autonomy of vessels. Indicatively, the use of innovative technologies for the electrification of vessels can be achieved through:

- their electric charging at ports to store power for their maximum energy autonomy at sea (hybrid vessels / electric vessels) and/or
- a combination of the use of RES (solar panels and wind turbines on vessels) to achieve the full energy autonomy of vessels.

Indicatively, the proposed actions for the following period could be the following:

- Encouraging Port Authorities and Operators to adopt port air quality protection policies against pollution caused by SOx, NOx and particulate matter emissions.
- Initiatives to reduce greenhouse gas and carbon emissions caused by port operation. Promoting policies to monitor and reduce emissions into the air associated with key port activities: shipping, cargo operations, freight handling.
- Promoting continuous improvement and energy-saving policies in ports, with an emphasis on operational efficiency and clean technologies.
- Developing monitoring mechanisms between the Ministry of Maritime Affairs and the Islands and Port Authorities and Operators for setting goals, monitoring performance and reporting on the progress made towards achieving climate change mitigation targets.

The purpose of these actions is to analyse and capture the respective general programming plans of the ports and to set specific energy efficiency and climate objectives. At this level and within the next programming period, it is envisaged to develop specialised programmes to support the adoption of such integrated interventions, contributing decisively to the achievement of the NECP's central climatic and energy objectives and the enhancement of the competitiveness of Greek ports.

3.7.3 Policies and measures in tourism

3.7.3.1 Sustainable tourism development and destination management plans

Sustainable tourism development is a key priority for the tourism sector. The development and implementation of an integrated Sustainable Tourism Development Strategy will be the key tool for achieving this goal.

In particular, it will support the development of processes for the design and implementation of innovative sustainable tourism policies and new innovative tourism products and tools for sustainable tourism taking into account international practices and their smooth adaptation to local conditions. In any case, the goal is to promote an holistic sustainability concept and to develop local communities and economies. The production of these tourism products and sustainable tourism tools will be complemented by the development of an integrated framework for their evaluation and certification, such as the establishment of Sustainable Tourism Observatories in strategically selected destinations.

Moreover, pilot actions to develop management plans and sustainable development of tourist destinations will be implemented to include new destinations in the traffic map, which is a key priority of the strategic development plan.

Finally, the development of a Sustainable Destination Management strategy will reinforce the identity of destinations by introducing a new holistic concept that encompasses living landscapes and natural environments, cultural characteristics, the human element, historical identity and local products. In this context, the development of new forms and emerging trends in sustainable thematic tourism, such as the development and interconnection of cultural routes and primary sectors, the development of forms of tourism with an environmental footprint, and sustainable maritime tourism, are important.

3.7.3.2 Promoting the use of RES and energy efficiency performance actions in tourist complexes

Financing programmes will be designed and implemented to promote the use of RES for heating, cooling and hot water use, as well as to improve energy efficiency in hotels, tourist accommodation and establishments serving food. Moreover, measures will be designed to install mainly photovoltaic systems through the energy offsetting and virtual energy offsetting scheme.

Energy-efficient heating, cooling, ventilation and lighting systems will be introduced into tourist complexes. For the production of thermal and cooling energy in particular, this objective will be achieved by both individual and central systems. In this regard, the potential of installing micro-cogeneration systems will be explored.

Emphasis will be placed on the implementation of energy management measures for tourist complexes, and the potential of developing specifications for the installation of energy saving systems in tourist areas possibly for new facilities (e.g. bioclimatic buildings and compliance with 'green standards'), will be explored.

Targeted information and awareness programmes will be launched for both tourists and Greek tourism and catering professionals through specific tools, such as the development of targeted energy inspections, the establishment of energy and environmental footprint criteria and reporting on certification and energy signalling schemes.

Regarding waste management, pilot social contribution-based recycling programmes will be designed in hotel complexes, with an emphasis on supporting the smooth transition of tourist destinations to an era when plastic use will be prohibited. Moreover, hotel complexes are planned to be supported to participate in solid waste management programmes in cooperation with local municipal cleaning services.

In the transport sector, support will be provided for the gradual electrification of tourist areas through pilot actions on public transport and electric bicycles and the installation of charging stations. Finally, the goal of digital sustainable development and destination management will, inter alia, promote active modes of transport, such as walking and cycling.

3.7.4 Summary of policy measures

Table 25 summarises the policy measures envisaged for the agricultural sector, shipping and tourism.

Table 25: Envisaged policy measures for the agricultural sector, shipping and tourism.

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M1	**Use of waste (agri-livestock units and industries, urban)**	**PPN.1, PPN.4, PPN.5**	Waste reduction RES penetration increase	Electricity	Regulatory, economic measure
M2	**Supply chain organisation and land planning of sites for temporary storage of agricultural/forest residual biomass**	**PPN.1, PPN.4, PPN.5**	Waste reduction RES penetration increase	All final consumption sectors	Regulatory, technical, economic measure
M3	**Maintaining and extending the sustainability certification scheme for biofuels, bioliquids and solid fuels**	**PPN.1, PPN.4, PPN.5**	Waste reduction RES penetration increase	Electricity Heating and cooling Transport	Regulatory measure
M4	**Sustainable forest management**	**PPN.1, PPN.4**	Waste reduction Increase in absorption of GHG emissions	All final consumption sectors	Regulatory, technical, economic measure
M5	**Production of solid biofuels through the promotion of energy crops of woody biomass or coppice plantations**	**PPN.1, PPN.4, PPN.5**	Waste reduction RES penetration increase	Heating and cooling	Economic measure
M6	**Creation and strengthening of the domestic bioethanol market**	**PPN.4, PPN.5**	RES penetration increase	Transport	Economic measure
M7	**Specific measures to reduce greenhouse gas emissions in the agricultural sector**	**PPN.5**	Reduction in GHG emissions	Total final energy consumption	Regulatory, economic measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M8	**Installation of RES systems through the energy netting and virtual energy netting scheme**	**PPN.5**	RES penetration increase	Electricity	Economic measure
M9	**Installation of RES in high productivity land**	**PPN.5**	RES penetration increase	Electricity	Regulatory measure
M10	**Promotion of RES systems for heating and cooling**	**PPN.5**	RES penetration increase	Heating and cooling	Economic measure
M11	**Boosting the consumption of biofuels**	**PPN.4, PPN.5**	RES penetration increase	Heating and cooling Transport	Regulatory measure
M12	**Improving the energy efficiency of existing machines and installations**	**PPN.5**	Improvement in energy efficiency	Total final energy consumption	Economic measure
M13	**Improving the energy efficiency of pumping stations and irrigation systems**	**PPN.5**	Improvement in energy efficiency	Total final energy consumption	Economic measure
M14	**Provision of information to and training of agricultural professionals**	**PPN.5**	Increasing RES penetration and improving energy efficiency	Total final energy consumption	Information measure
M15	**Introduction of fuel consumption obligations with a specific sulphur content and emission control regulatory framework.**	**PPN.1**	Reduction in GHG emissions	Transport	Regulatory measure
M16	**Promoting the use of liquefied natural gas.**	**PPN.1**	Reduction in GHG emissions	Transport	Technical, economic measure Regulatory

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M17	**Development and implementation of infrastructure and a supply chain for the safe bunkering of LNG to ships.**	**PPN.1, PPN.3**	Reduction in GHG emissions	Transport	Technical, economic, Regulatory measure
M18	**Design and integration of local RES units in port areas in the form of self-production.**	**PPN.3**	RES penetration increase	Electricity	Economic measure
M19	**Electrification of key energy-consuming installations at ports.**	**PPN.3**	Increasing RES penetration and improving energy efficiency	Electricity	Technical, economic measure
M20	**Electrification of ships either during mooring or for inland voyages.**	**PPN.3**	Increasing RES penetration and improving energy efficiency	Electricity	Technical, economic measure
M21	**Strengthening local electricity networks at the level of substations.**	**PPN.3**	Increasing RES penetration and improving energy efficiency	Electricity	Technical measure
M22	**Development of a regulatory framework for the supply of electricity to ships**	**PPN.3**	Increasing RES penetration and improving energy efficiency	Electricity	Regulatory measure
M23	**Actions to improve the energy efficiency of ships and the adoption of energy management systems.**	**PPN.3**	Improvement in energy efficiency	Total final energy consumption	Economic measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M24	**Promoting sustainable tourism development and destination management**	**PPN.7**	Supporting sustainable development	Total final energy consumption	Regulatory, economic measure
M25	**Developing innovative tourism products and sustainable tourism tools**	**PPN.7**	Supporting sustainable development	Total final energy consumption	Economic measure
M26	**Promoting the use of RES for heating, cooling and domestic hot water**	**PPN.7**	RES penetration increase	Heating and cooling	Economic measure
M27	**Promoting actions to improve energy efficiency and energy management measures for tourist complexes.**	**PPN.1, PPN.7**	Improvement in energy efficiency	Total final energy consumption	Economic measure
M28	**Installation of RES systems through the self-generation scheme.**	**PPN.7**	RES penetration increase	Electricity	Economic measure
M29	**Development of specifications for the installation of energy-saving systems in tourist areas**	**PPN.1, PPN.7**	Improvement in energy efficiency	Total final energy consumption	Regulatory measure
M30	**Targeted information and awareness programmes for tourists and professionals.**	**PPN.7**	Improvement in energy efficiency	Total final energy consumption	Information measure
M31	**Waste management and recycling programmes.**	**PPN.7**	Reduction in GHG emissions	Total final energy consumption	Regulatory, technical, economic measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M32	**Promoting electrification in tourist areas and promoting active modes of transport**	**PPN.7**	Increasing RES penetration and improving energy efficiency	Electricity	Technical, economic measure

3.8 Research, innovation and competitiveness

The definition of policy measures to promote Research, Innovation and Competitiveness in the period 2021-2030 aims to cover eleven different Policy Priorities (PP6.1-PP6.11), which are presented in Figure 10.

PP6.1: Innovative applications with a high potential for domestic added value and strengthening of openness of enterprises

PP6.2: Development of innovative energy-saving technologies

PP6.3: Development of innovative decarbonisation technologies

PP6.4: Smart grids

PP6.5: Development of innovative technologies in transport and applications for micro-mobility

PP6.6: Development of innovative energy storage applications and of CO_2 capture, storage and use technologies

PP6.7: Promoting innovative technologies to support circular economy actions

PP6.8: Implementing horizontal measures to improve the conditions for research

PP6.9: Promoting entrepreneurship through research and innovation actions which are part of market functions

PP6.10: Optimising support framework and schemes for promoting investment with a view to strengthening competitiveness

PP6.11: Strengthening competitiveness by setting up and operating special funds

Figure 10: Policy Priorities of policy measures to promote Research, Innovation and Competitiveness in the period 2021-2030.

The policy measures that have been specified in the above policy priorities are analysed separately in the following sections.

3.8.1 Policies and measures to achieve the relevant objectives

3.8.1.1 Policies and measures to promote research and innovation

Policy measures to promote research and innovation are strongly related to the technologies promoted within the framework of the Energy Union. It should be noted that the aim of research and innovation actions is twofold: on the one hand, to lead to high domestic value added applications and, on the other hand, to enhance business extroversion as a proportion of these applications will be exported to other countries.

The energy efficiency improvement objectives set in all areas of end use of energy create significant challenges that, to be addressed, there is an urgent need to step up research into new materials and innovative applications of heating and cooling systems, with an emphasis on improving their reliability and automated operation. At the same time, the maturation and integration of innovative energy-saving technologies that contribute significantly to improving energy efficiency, will be facilitated.

In particular, research and innovation activities related to improving the energy efficiency of buildings will include:

- ✓ New building materials: Innovative materials and building technologies that will support a recycling process, innovative thermal insulation building systems with improved thermal performance, innovative thermal insulation system without materials derived from mineral sources.
- ✓ Prefabricated active roof and facade elements**:** Standard panels for ventilated facades or roofs combining photovoltaic and thermal solar systems, thermal insulation, phase change materials, batteries.
- ✓ Cost-effective, intelligent, flexible heat pumps and high-temperature heat pumps**:** Intelligent heat pump adjustable to provide additional services to the grid, versatile heat pump to provide a wider operating range and operation control equipment, further development & deployment of absorption technologies and heat pump adsorption systems.
- ✓ Digital programming and operational optimisation: Automated fault detection and diagnosis, combining statistics and technical data to improve energy demand forecasts and updating-upgrading building assessment methods.

Accordingly, the following will be supported in the industrial sector:

- ✓ Energy-efficient heating and cooling technologies: High temperature compression refrigeration cycle heat pumps with low global warming potential refrigerants for use in industrial medium temperature applications and in district heating and cooling.
- ✓ Heat/refrigeration recovery: Use of low temperature waste heat to generate electricity at higher efficiency, high temperature waste heat recovery with sCO_2 cycle, hybrid waste heat recovery stations incorporating RES in industrial plants and processes.
- ✓ Integration of systems: Industrial integration of energy-intensive industries to exploit energy loss streams and better energy management globally, unconventional sources of energy in the manufacturing industry, further integration of digitisation into process and plant management.

Specifically for the chemicals and pharmaceuticals sector, provision is made for the (re)design and optimisation of the chemical reactor and process, the development of alternative energy efficient separation technologies and the introduction of electricity into the chemical processes.

Achieving the goal of reducing greenhouse gas emissions in all sectors of economic activity is expected to lead both to the full and market-based integration of mature decarbonisation technologies in the energy market and to the gradual penetration of less competitive technologies. This particular transition to a new production and demand model presents significant technological challenges, requiring the development of know-how and the promotion of innovative technologies.

In particular, provision is made to support research and innovation on the RES technologies shown in Table 26 in the coming period.

Table 26: Research and innovation actions in RES technologies to reduce greenhouse gas emissions in all sectors of economic activity.

RES technology	Research & Innovation Actions
Solar thermal energy for electricity generation	Implementation of linear concentrating solar power (CSP) collectors technology with storage capacity at a commercial scale.
	Reduction of the costs and increase of the efficiency of Fresnel CSP linear collectors.
	Development of new heat storage materials and techniques suitable for CSP systems.
Solar thermal energy for heating and	Development, standardisation and implementation of hybrid systems in intelligent buildings.

cooling applications	Digitisation of solar thermal systems - development and experimental production of smart meters, development and demonstration of applications for users and professionals.
	Work models and pilot applications for the integration of solar thermal systems into smart grids, integrated hybrid RES systems for heating and air-conditioning in buildings with a priority in solar thermal systems.
	New materials, production methods, solar thermal system parts to ensure cost savings and to be used into integrated systems.
	Development of standardised solar thermal systems for heat generation in industrial processes.
Bioenergy (bio-solids, bio-liquids, bio-gases and bio-energy intermediates)	Development of solid, liquid and gaseous bio-energy intermediates through biochemical/thermochemical/chemical conversion from sustainable biomass
	Demonstration of solid, liquid and gaseous bio-energy intermediates through biochemical/thermochemical/chemical conversion from sustainable biomass
	Scaling up of solid, liquid and gaseous bio-energy intermediates through biochemical/thermochemical/chemical conversion from sustainable biomass
	Development of solid, liquid and gaseous bio-energy intermediates through biochemical/thermochemical/chemical conversion from sustainable biomass
Wind power (offshore wind farms & small wind turbines)	Wind park electrical infrastructures (wind park coupling equipment with network support services, underwater power cables for up to 200m installation and connection to floating wind turbines).
	Offshore wind farms (pre-industrial fixed-type offshore wind turbines for depths of 50-60m, float type 80-200m depths and floating platform for measurement, floatable wind turbine fastening system for depths of 80-200m, feasibility studies for development of floating wind turbine construction centres).
	Operation and maintenance of wind farms (data collection-processing system for continuous operational control of wind turbines, software for processing large volumes of data from the operation and maintenance of wind farms and analysis of operating parameters, drones or robotics for control and maintenance of wind turbines, evaluation methodologies for the residual life of wind turbines).
	Small wind turbines (pre-industrial standards with improved aerodynamic efficiency or low sound footprint, small wind turbine quality control and certification procedures & infrastructures).
	Other issues (e.g. integrated environmental footprint capture and assessment methodologies-tools, end-of-life management system, feasibility studies and pilot applications for utilising existing lignite

	infrastructure).
Photovoltaic (PV) energy	Integration of PV systems into buildings and other infrastructures (new high performance thin film PV cells, hybrid systems incorporating various PV technologies with other power generation technologies, innovative systems for integrating PV in buildings and infrastructure and interconnection with other applications, methods for measuring the efficiency and durability of PVs in real time & in the long term and in accelerated aging conditions).
	Development of high energy efficient multi-contact technology photovoltaic cells (perovskite technology multi-contact cells deposited on Si/CGIS, new methods and tools for deposition and transport of III/V absorber, GaP deposition techniques on Si, manufacturing techniques for wide-bandgap semiconductors as upper absorbers, adaptation of Si/CGIS technology as lower absorbers, performance test in real conditions).
	PV plants and facilities monitoring and operating systems (advanced and automated analysis of various databases, standardisation and self-monitoring of sensors, communication of inverters of a PV module and between different PV installations).
Deep geothermal energy	Geothermal heating in urban areas (harnessing the potential of geothermal fields for urban heating).
	Materials, methods and equipment to improve operating availability (plastic materials for pipelines and heat exchangers for the 90-99^{o}C temperature range, anti-salinity agents specific to fluids from Greek geothermal fields).
	Improving the permeability of conventional geothermal reservoirs, with interest from users already exploiting or intending to exploit low enthalpy geothermal fields.
	Improving electricity conversion efficiency and direct use of heat (hybrid geothermal-biomass power plant, geothermal power plant with cooling water to supply the district heating network).
	Developing new geothermal potential exploration techniques, including geothermal potential forecasting and exploratory drilling.
	Integrating geothermal heat and electricity into the energy system (development of a variable load geothermal power plant that will complement wind and PV energy).
	Developing a zero-emission geothermal power plant.

The key priority of research and innovation for the coming period in the field of energy networks are the challenges of digitising them and developing smart grids. The main research and innovation actions to be strengthened in the area of electricity distribution networks are as follows:

- ✓ Creating an innovation environment for the development of smart services: Market planning for the marketing of heterogeneous flexibility products, cyber security of critical energy infrastructure, innovation regulatory zones, process chain for interoperability of ICT systems, systemic and socio-economic impacts of digitisation on the energy system.
- ✓ Developing an optimised electricity network:
  - Developing and implementing solutions to increase the observability and controllability of the energy system: Increased observability and controllability of medium and low voltage networks with high penetration of distributed energy resources, smart-flexible design, programming and operation of the network based on improved transmission network observability.
  - Developing and implementing solutions and tools for load profile management through demand response and control in order to optimise network usage and defer investment in networks: Customer involvement and new markets & business models, EV/PHEV charging infrastructure and integration into smart energy systems, demand response engineering.
  - Developing and implementing solutions to increase the flexibility of all types of production: Interactions between flexible generation and the power generation system, ancillary services in scenarios with very high RES penetration and low mechanical inertia, increasing flexible production through the use of integrated storage in power plants.
  - Reducing the cost of all energy storage solutions by minimising the total cost of the system: Multi-service storage applications to facilitate innovative synergies between system administrators and market players, advanced energy storage technologies for energy and power applications.
- ✓ Developing integrated local and regional energy systems:
  - Integrating RES at regional and local level, including different energy providers: Optimising the design, management and monitoring of integrated regional energy systems, a transnational joint programming platform for smart, integrated, regional energy systems.
  - Creating an innovation environment for smart services in collaboration with ICT platform solution providers.

In addition, innovative actions relating to electric vehicles and to strategies for their recharging will be supported and emphasis will be placed on the fact that the electricity consumed should come from RES and hydrogen produced by various forms of energy. Similar actions for the development of innovative technologies will also be supported in the case of biofuels as renewable fuels for sustainable transport (fuels for road transport, air transport), which include:

- ✓ Developing advanced liquid and gaseous biofuels through biochemical/thermochemical/chemical conversion from sustainable biomass and/or autotrophic microorganisms and primary energy from RES.
- ✓ Demonstrating advanced liquid and gaseous biofuels through biochemical/thermochemical/chemical conversion from sustainable biomass and/or autotrophic microorganisms and primary energy from RES.
- ✓ Developing other liquid and gaseous fuels (excluding hydrogen) through thermochemical/chemical/biochemical/electrochemical conversion of energy neutral carriers with renewable energy.
- ✓ Demonstrating other liquid and gaseous fuels (excluding hydrogen) through thermochemical/chemical/biochemical/electrochemical conversion of energy neutral carriers with renewable energy.
- ✓ Production of renewable hydrogen from electrolysis of water and electricity from RES (installed electrolytes at renewable hydrogen refuelling stations).

Actions to design efficient liquefied natural gas storage facilities for bunkering will also be supported.

With regard to energy storage, measures will be taken to strengthen the development of new or improved electricity or thermal energy storage technologies with higher efficiency, availability, durability, security and at the lowest cost. Support will be provided for electrochemical energy storage technologies, which relate primarily to RES applications for utilisation in non-interconnected electricity networks or in remote points in the electricity network, in particular:

- ✓ Developing 4.5-5V high-voltage and fully solid state lithium-ion batteries for all vehicle power applications (developing additives or materials modifications to improve safety, determining performance characteristics at low temperatures).
- ✓ Studying the effect of quick/very quick charging of lithium-ion batteries on materials and battery degradation (understanding phenomena and measuring the effect of high C coefficient on existing and advanced lithium-ion batteries, evaluating progress on quick/very quick chargers: from existing 120 kW to future +300 kW, proposals for measures to reduce cell degradation: changes in materials, thermal management, element and shell design by incorporating optimised thermal management and safety mechanisms, designing appropriate charging stations chilled using coolant).
- ✓ Progress made on batteries for static energy storage applications: Achieving fixed interfaces for extending the life cycle and lifespan of the systems.
- ✓ Other battery technologies (after Li-ion) for electromobility: Developing appropriate detection, monitoring, thermal management and security systems.
- ✓ Li-ion and later Li-ion battery recycling (developing low-cost packaging for secure reverse logistics; developing an improved reverse logistics business model).
- ✓ Lithium recovery from geothermal brines and sustainable enrichment processes for indigenous lithium deposits in hard rock: Mapping and locating interesting geothermal resources in terms of lithium content.
- ✓ Enhancing the development of cell and battery production equipment (change in sheet & coating thickness, cost-effectiveness of switching from high-power to high-energy materials, etc.).
- ✓ Developing hybrid battery systems for static energy storage applications (study of new materials for hybrid systems, design of components and systems specifically for hybrid systems, study of advanced battery management systems for hybrid systems).

- ✓ Second use and smart integration of batteries into the grid (feasibility study for quantification of 2nd life criteria, creation of test protocols according to the 2nd use end application, implementing aging tests to the most promising batteries, developing models to better understand and predict the performance of current and next-generation Li-ion batteries, studying the establishment of a roadmap of convergence from the current situation, suggestions for updating and/or creating a common set of standards, developing proposals for a set of demonstration projects to gain more knowledge and experience of using batteries for EV applications in the Fixed Storage Market, a standardised platform with the key characteristics of the batteries and their components).

Promoting research and innovation in the energy sector requires the active involvement of all market players. The strategic choices made by the enterprises in the sector (power transmission and distribution), the policies pursued by public bodies and authorities, as well as the tools for financing the actions implemented by the enterprises should be driven by synergies to the greatest possible extent.

Horizontal support policies include:

- ✓ Establishment of a monitoring and control mechanism to maximise synergies between energy, research and competitiveness policies and support it with the necessary resources.
- ✓ Regulatory measures for the easier and more efficient implementation of research or pilot projects by all market players, with the ultimate goal of creating benefits for final consumers.
- ✓ Measures to promote partnerships between all stakeholders by supporting advisory and networking actions among stakeholders to facilitate the transfer of know-how and the maximisation of synergies.

Finally, innovative applications will contribute to mitigating the environmental impact of businesses and the impact of climate change on the urban environment, as well as promoting the circular economy, with an emphasis on the recovery of materials and the recovery and reuse of energy, concentrating on the recovery of materials and the recovery and reuse of wasted energy as well as innovative CO2 capture and/or reuse techniques.

In the specification and implementation of these policies and measures, there will be close cooperation with national and regional smart specialisation planning and implementation bodies. Energy is already one of the priority areas of the National Smart Specialisation Strategy and certain regional ones. The involvement of energy sector stakeholders in the business discovery process is the key to maximising the intended results.

3.8.1.2 Policies and measures to promote competitiveness

Promoting knowledge-driven entrepreneurship is also a priority by directly contributing to the competitiveness component. To this end, it is planned (a) to set up and operate special funds to promote research and innovation in SMEs, to co-operate with research centres and to ensure the conditions for successful investment, and (b) to exploit patent rights, licensing, etc.

Support will also be given to the creation of innovative clusters of companies and research entities to promote healthy entrepreneurship, and to the establishment of knowledge-intensive start-ups for the commercial exploitation of mature research results and innovative ideas, as well as for the development of entrepreneurship support structures, such as incubators, technology parks, co-working spaces, etc.

Enhancing competitiveness calls for improving the existing regulatory framework for the implementation of investments in industrial plants and in SMEs, in order to create a stable and transparent framework of rules, procedure and administrative structures with a view to completing smoothly large public and private projects. In addition, in order to ensure more private capital, the effectiveness of the existing private investment aid schemes will be assessed in order to continue implementing the most efficient among them and/or to attempt to implement new ones.

The role of special target funds will also be important for facilitating the provision of concessional financing to SMEs and for undertaking part of the business risk which is not undertaken by financing institutions, while providing the necessary guarantees.

The contribution of circular economy to improving competitiveness is considered to be particularly important and it is, therefore, necessary to promote concrete actions focusing on the development of innovative technologies to achieve the objectives of the National Circular Economy Strategy.

3.8.2 Cooperation with other Member States in this area

Cooperation with other countries in the area of research and innovation is shaped by the transnational collaborations of the GSRT, which are an integral part of its overall activity in making and strengthening research policies. These collaborations cover a wide range of bilateral, tripartite and multilateral actions as a result of the country's international policy and the joint will of the governments involved. The forms of multilateral cooperation vary from cooperation at ministerial level (e.g. Organization of the Black Sea Economic Cooperation) or collaborations, initially decided at ministerial level and implemented by researchers/scientists (e.g. ERANETS). The Territorial Cooperation Programmes – Interreg for the period 2021-2027 will be used to promote cooperation with other Member States in the field of energy and climate.

3.8.3 Financing of measures in this area at national level, inter alia with EU support and the use of EU funds

The key financial instruments include:

- Domestic resources
- Operational programmes under the new programming period
- Specific operational funds with public and private capital
- National, European, transnational and international programmes to support research actions and the implementation of innovative and pilot applications

3.8.4 Summary of policy measures

Table 27 summarises the policy measures envisaged to achieve individual objectives as part of the research, innovation and competitiveness dimension.

Table 27: Contemplated policy measures to promote Research, Innovation and Competitiveness.

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M1	**Development of innovative energy-saving technologies**	**PP6.1, PP6.2**	Promotion of research and innovation	Energy efficiency, Consumer-focused smart energy system RES	Economic measure
M2	**Development of innovative decarbonisation technologies, as well as applications for carbon capture, storage and utilisation**	**PP6.1, PP6.3**	Promotion of research and innovation Development of low-carbon technologies	RES Carbon capture, use and storage	Economic measure
M3	**Smart grids**	**PP6.1, PP6.4**	Promotion of research and innovation	Consumer-focused smart energy system	Economic measure
M4	**Promotion of innovative technologies in transport**	**PP6.1, PP6.5**	Promotion of research and innovation Development of low-carbon technologies	Sustainable transport	Economic measure
M5	**Development of innovative energy storage applications**	**PP6.1, PP6.6**	Promotion of research and innovation	Sustainable transport Consumer-focused smart energy system	Economic measure
M6	**Implementation of horizontal measures for improving the conditions for conducting research**	**PP6.8**	Promotion of research and innovation	All NECP subject fields	Regulatory measure

Numbering	Name of policy measure	Correlation with policy priorities	Target	Sector affected	Category of measure
M7	**Promotion of entrepreneurship through research and innovation actions which are embedded in market functions**	**PP6.9**	Improvement of competitiveness	All NECP subject fields	Economic measure
M8	**Optimising support framework and schemes for promoting investment with a view to strengthening competitiveness**	**PP6.10**	Improvement of competitiveness	All NECP subject fields	Economic measure
M9	**Strengthening competitiveness through the establishment and operation of Special Target Funds**	**PP6.11**	Improvement of competitiveness	All NECP subject fields	Economic measure
M10	**Promoting innovative circular economy technologies**	**PP6.1, PP6.7**	Improvement of competitiveness	All NECP subject fields	Regulatory, economic measure

Chapter 4 ENERGY SYSTEM DEVELOPMENT RESULTS BY 2030

4.1 Summary presentation of the existing situation

The total greenhouse gas emissions experienced a decline of 30%in 2017 in comparison with 2005[17], while in absolute figures they were found to be at a lower level than those of 1990. The greenhouse gas intensity indicator decreased during the period 2005-2017 (decline of 7 %) mainly because of high RES penetration and reduced energy consumption both due to the implementation of energy efficiency improvement measures, but also due to the economic downturn (Chart 7).

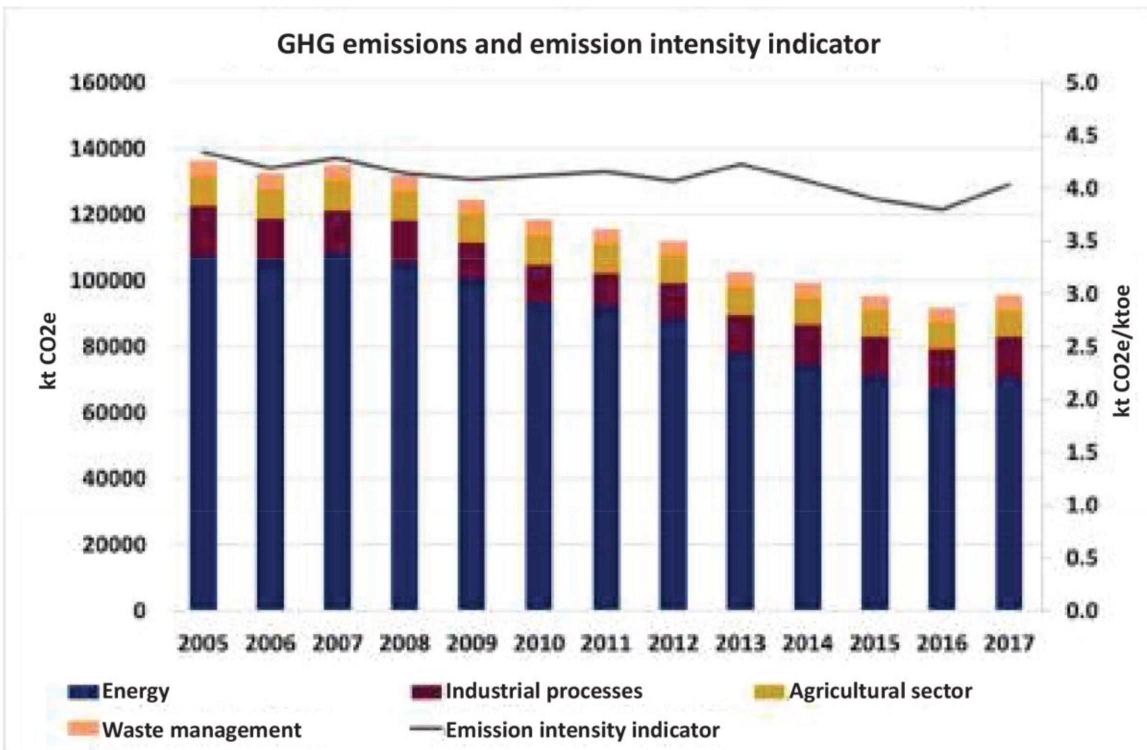


Chart 7: Development of greenhouse gas emissions per contribution sector and emission intensity indicator[18].

[17] The depiction of values in the present section shall be made specifically for the period 2005-2017 in order to establish correlation with the objectives in the context of relevant policies.
[18] Does not include emissions from the international aviation sector.

In 2017, there was a slight increase of 4.1% in total GHG emissions compared to the total emissions for 2016, mainly due to the higher share of fossil fuels in gross domestic consumption.

The contribution of the energy sector in the overall greenhouse gas emissions is the highest when compared to emission produced by other business areas. In particular, fossil fuel combustion for the electricity generation and heat constitutes the most important factor which contributes to the development of the existing situation.

Over the entire energy system, gross domestic energy consumption declined significantly by 21% over the period 2006-2017 (Chart 8). Compared to the previous year (2016) there is an increase of 3.3%. The increase in RES penetration into gross energy consumption continues and almost doubles in 2017 compared to 2006. At the same time, the share of solid fuels decreased by 43% over the period 2006-2017.

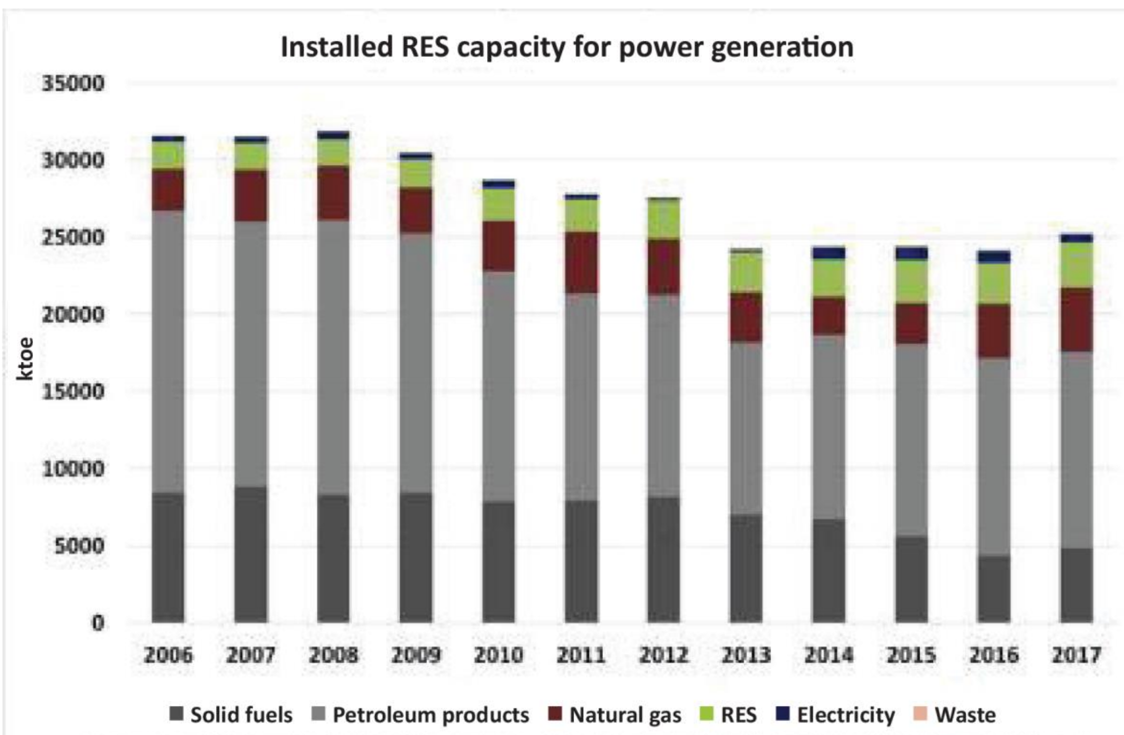


Chart 8: Evolution of fuel shares in gross domestic energy consumption for the period 2006-2017.

The slight upward trend in final energy consumption in recent years (2015, 2016) seems to stabilise in 2017, with a marginal increase in final consumption of 0.3% compared to 2016 (Chart 9).

During the period 2006-2017, a decrease in final energy consumption is recorded for all end-use sectors. The greatest decline was in the industrial sector (27% decrease), followed by the residential and transport sector, with a respective 21% and 20% decrease in final consumption compared to 2006. The tertiary sector shows a lower, 6% decrease over the same period.

However, during the period 2013-2017 almost all end-use sectors showed an increase of the final consumption of energy. The greatest increase was found in the residential and the industrial sector (increase of 16% and 9%, respectively), while the increase in the transport and the tertiary sector was 8%.

For 2017, the transport sector has the largest contribution as a share to the final consumption of energy (41%), while the participation of both the residential and the industrial sector (shares of 26% and 18%, respectively) is also significant.

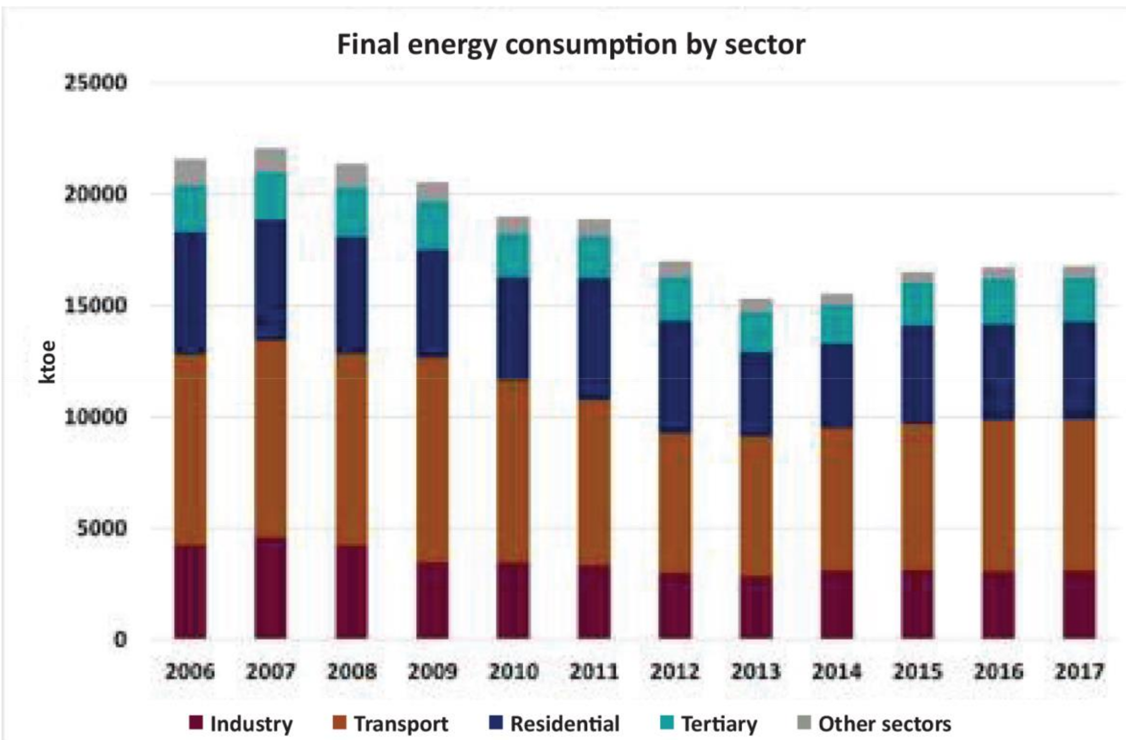


Chart 9: Final energy consumption evolution by sector of end-use for the period 2006-2017.

Chart 10 shows the contribution of the different types of fuels to the final consumption of energy during the period 2006-2017. The greatest share in the end-use sectors corresponds to the consumption of oil products (56% for 2017), followed by electricity, RES and gas at 28%, 8% and 7%, respectively. Consumption of solid fuels and oil products in the end-use sectors decreased significantly in 2017 compared to consumption levels in 2006 (by 53% and 37%

respectively). This decrease is largely offset by the dramatic increase in gas consumption (72%) from RES and electricity consumption, which increased by 24% and 3% over the period 2006-2017.

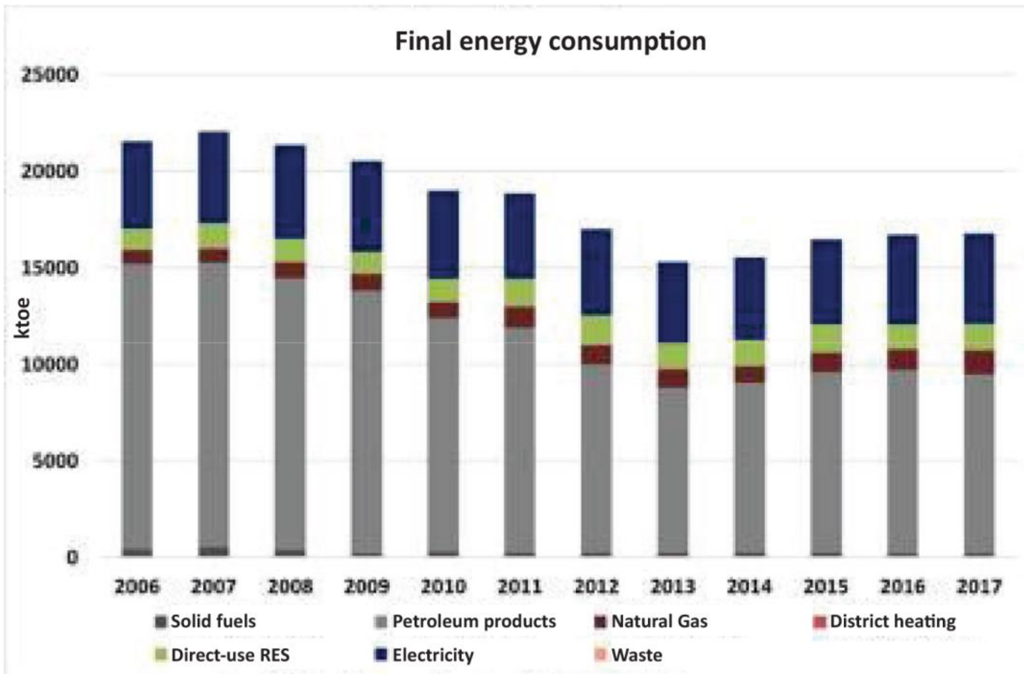


Chart 10: Evolution of fuel shares in end energy consumption for the period 2006- 2017.

The contribution of RES in the consumption of energy in the territory of Greece shows a significant increase in the period 2006-2017, since the total contribution for 2017 as a share in gross final consumption of energy is 17%, more than doubling the relative share corresponding to RES in 2006 (Chart 11).

With the exception of the transport sector, where the share of RES involved extreme variations and a steady increase over the last two years, 2016 and 2017, the contribution of RES in the gross consumption of electricity and in the final consumption of energy for heating during the period 2006-2016 showed a significant increase with an average annual growth rate close to 10%.

It is worth recalling that the variations observed at intervals in the share of RES concerning final consumption of energy for heating, are exclusively due to the use of solid biomass, the use of which has fluctuated over the last few years, after significant increases observed at the beginning of the current decade and culminated in the year 2012.

The share of RES to the gross consumption of electricity in 2017 reached 24.5% by producing a tremendous growth compared to 2006, when the corresponding share was 9%. In particular with regard to the electricity generation from RES with characteristics of non-controlled generation, i.e. electricity generation from photovoltaic and wind power stations, the percentage of this share is already more than 15% in gross final consumption of electricity and is significantly higher than the corresponding market share at the level of the European Union.

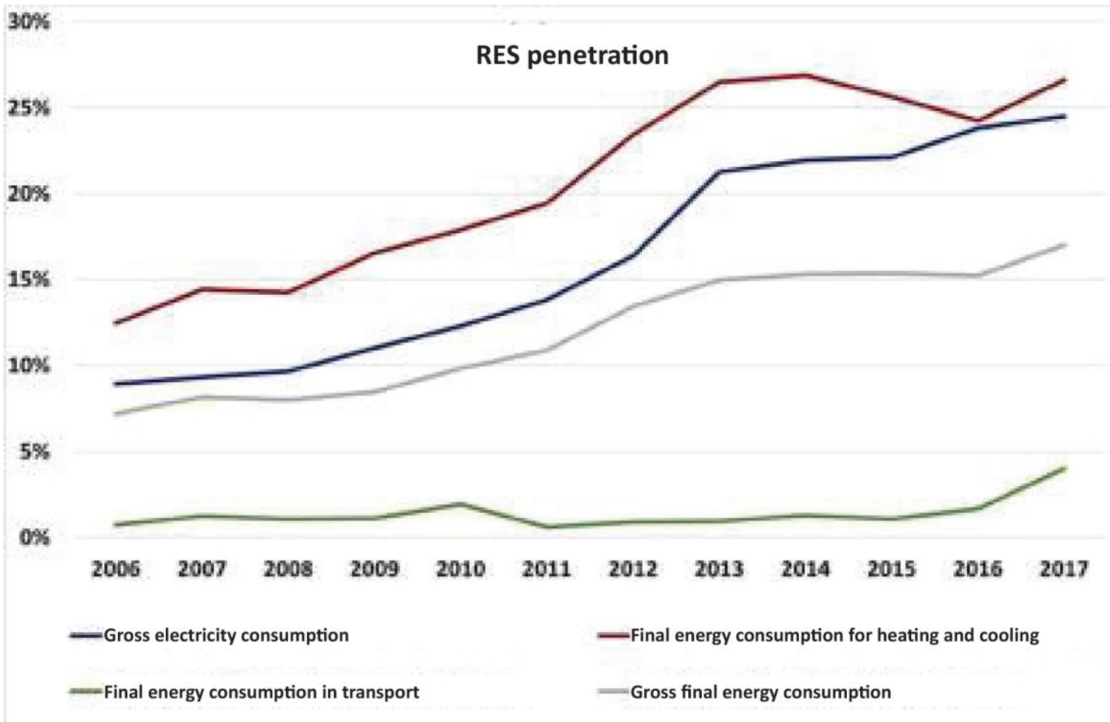


Chart 11: Total and specific RES shares in the domestic energy system on the basis of EU methodology.

4.2 Estimated development of the main external factors affecting the energy system and the greenhouse gas emissions

This chapter presents an update of key macroeconomic assumptions such as international fuel prices and emission allowance prices as well as domestic macroeconomic indicators that have undergone a significant change.

The assumptions made for the individual parameters affecting the evolution of the energy system, which limit or enhance the development of individual energy figures, are summarised in the forecasts for the evolution of the following figures for the period 2018-2030:

i. economic activity by industry
ii. population and number of households

iii. international fuel prices
iv. prices of greenhouse gas emission allowances
v. evolution of the investment cost of energy technologies
vi. potential of RES technologies
vii. development of electricity and natural gas infrastructure

The evolution of demand for useful energy in the final consumption sectors (buildings, transport, etc.) is driven by both the evolution of economic activity per industry and the evolution of population, households, household size, production capacity of individual industrial sectors and other macroeconomic and demographic parameters.

The reference year shall be both 2016 and 2017, as they are the most recent years for which there is a complete official national energy balance.

4.2.1 Macroeconomic and demographic projections

The key assumptions used by the two energy simulation models (TIMES and PRIMES) applied in the preparation of the NECP are common in order to have a common view of the external factors affecting the evolution of the energy system. More information on the two simulations and their results can be found in Chapter 4.3. Any assumptions relating to the country's aggregates and population figures have been taken into consideration by the Ministry of Finance and are summarised in the Table 28.

Table 28: Common macroeconomic and demographic projections for the preparation of the NECP.

	2015	2020	2025	2030
Population (millions)	10,858	10,691	10,538	10,368
GDP (EUR million $_{2010}$)	184,773	200,082	221,662	244,733

4.2.2 Sectoral changes expected to affect the energy system and the greenhouse gas emissions

Accordingly, projections relating to the development of the individual sectoral aggregates have been taken into consideration by the Ministry of Finance and are summarised in Table 29.

Table 29: Common sectoral projections for the preparation of the NECP.

Aggregates Fixed values for 2010	**2015**	**2020**	**2025**	**2030**
Gross Value Added [€ million]	**165151**	**177986**	**202347**	**223407**
Agriculture, forestry and fisheries	7.116	7.119	7.892	9.160
Mining-Quarrying	581	481	506	536
Industry	14.193	16.375	18.211	20.107
Energy sector	2.145	2.492	3.136	3.575
Construction	4.174	5.810	6.608	7.266
Other sectors (rest of the tertiary, transport sectors)	136.942	145.709	165.994	182.764

The assumptions for household and transport work development, as they develop based on the architecture of the two energy models, present some differences which are summarised in Table 30 and Table 31.

Table 30: Projections for household and transport work development – TIMES energy model.

	2015	**2020**	**2025**	**2030**
Number of households [millions]	4.081	4.076	4.075	4.068
Household size [residents/household]	2.66	2.62	2.59	2.55
Passenger transport work				
Public road transport [million pkm]	16,285	16,866	18,528	19,861
Private vehicles [million pkm]	87,038	92,976	100,628	107,767
Two-wheel vehicles [million pkm]	5,941	5,932	5,932	5,921
Track-based modes [pkm]	1,325	1,323	1,585	1,746
Commercial transport work				
Trucks [million tonne-km]	21,897	23,049	27,518	30,549
Track-based modes [million tonne-km]	533	547	639	701

Table 31: Projections for household and transport work development – PRIMES energy model.

	2015	**2020**	**2025**	**2030**
Number of households [millions]	4.120	4.074	4.081	4.107
Household size [residents/household]	2.64	2.63	2.58	2.52
Passenger transport work				
Public road transport [million pkm]	21,100	22,843	23,517	24,092
Private vehicles [million pkm]	85,040	89,985	95,099	100,160
Two-wheel vehicles [million pkm]	5,500	5,400	5,639	5,871
Track-based modes [pkm]	1,263	1,325	2,099	2,281

	2015	2020	2025	2030
Commercial transport work				
Trucks [million tonne-km]	20,352	21,346	25,043	28,300
Track-based modes [million tonne-km]	306	367	384	404

4.2.3 Global energy trends, international fossil fuel prices, EU ETS emission allowance price

Table 32 summarises the updated assumptions regarding the development of international fuel prices and of EU ETS emission allowances. Gas prices, as well as the ETS emission allowance price, have been calculated taking into account the current corresponding prices, projections by market players and international estimates of their future evolution.

Table 32: Projections for the development of international fuel prices and emission allowances.

	2020	2025	2030
Gas price (including shipping and balancing costs) (€ 2016/GJ)	7.8	8.7	9.1
Gas distribution price (€2016/GJ)	6.80	7.71	8.12
Crude oil [€2016/GJ]	11.90	15.73	17.33
Emission allowance prices (€2016/t of CO2)	24.00	28.77	31.23

4.2.4 Technology cost developments

For the technology cost development of electrical generation technologies, there has been used data from the investment cost structure aiming at the development of such modules within Greek territory, as well as cost development projections on the basis of international and European studies. In analysing these studies, it was initially considered appropriate to keep development costs at the same current levels for a set of RES technologies. It becomes evident, following the results presented in the sections below, that this cost assessment affects both the type of the new power generation modules being installed as well as the electricity generation mix.

In terms of technology, a sharp reduction in the development costs of the photovoltaic parks and, at a smaller but equally significant rate, of wind farms, is suggested, while an improvement in the nominal capacity of the systems is envisaged for both of these technologies. It is noted, however, that, compared to photovoltaic parks on land, photovoltaics generally demonstrate a remarkable penetration in the construction sector, with comparatively higher costs and a reduced rate of utilisation.

Table 33 shows the relevant assumptions regarding the development of the development costs.

Table 33: Projections for the development of the full typical cost for electricity generation unit development from RES.

Development cost (€/kW)	2020	2025	2030
RES technologies for electricity generation			
Wind farm	1,161	997	860
Solar panels - park	552	473	420
Solar panels - roofs	1,019	907	816
Solar thermal park with storage	4,100	3,860	3,370
Geothermal	4,400	4,400	3,400
Hydroelectric - small	1,900	1,900	1,900
Biomass - large	2,700	2,700	2,700
Biomass - medium	3,500	3,500	3,500
Biogas	4,350	4,350	4,350

4.3 Projections for the development of the energy system and the emissions and absorptions of greenhouse gases

This section presents the assumptions and computational tools used to develop the baseline scenarios in support of the National Energy and Climate Plan. For the development of the scenarios, two complementary, energy simulation models were used with a common starting point for achieving the targets for the year 2030. Quoting the evolution of the energy system based on two different energy models, while using common initial assumptions, contributes to the further credibility of the methodological approach adopted when drawing up the final NECP and substantially forms two different scenario approaches and estimates to achieve the national energy and climate targets for the year 2030.

The two models were combined so that the projections offer both a holistic and more realistic estimation of the future evolution of the national energy system in a broader economic and political context. This combination is all the more necessary in the context of developing a long-term strategy covering a period of 30 years from 2020 to 2050.

The energy simulation models used consist of the widely used TIMES and PRIMES energy simulation models. TIMES follows a bottom-up approach by integrating a detailed description of the generation system and meeting the demand for useful energy at the lowest possible cost while making decisions on investment and operation of equipment, primary energy sources and imports/exports of energy products between the different areas. In addition, PRIMES follows a hybrid approach where the balance of supply and demand across all energy markets is shaped by estimating the costs and prices of energy products. The balance of markets is dynamic over time and, therefore, the model calculates intrinsically the energy investment as well as the use of equipment in both the demand and supply sectors. More information on how energy models work is provided in Annex D.

The results of the energy simulation of the two energy models for the scenario of achieving climate and energy objectives are compared in Section 4.4 to present at the level of scenario development and different performance of policy measures, alternatives to achieving the specific climate and energy objectives of the NECP. The sub-sections of Chapter 4.3 below mainly present the results from the TIMES energy model, for reasons of comparability and continuity with the detailed results of Annex B (evolution of the energy system under existing policies), the detailed results of the NECP initial plan, and the more detailed time step of the evolution of the energy system.

4.3.1 Formulation of a scenario of additional policies and measures

An energy policy scenario with additional measures, in addition to those already implemented or adopted (objectives achievement scenario), taking into account the policy measures presented in Chapter 3, has been developed for the preparation of the NECP and the achievement of the relevant energy and climate objectives that have been set.

The formulation and analysis of the scenario of additional measures and policies aims to evaluate parameters affecting the energy system and establish additional national policies, which would fulfil at the same time both the challenges faced by the energy sector in Greece and the obligations arising from the harmonisation of the national framework with the EU Energy and Climate Policy.

As it happens with the scenario of existing policies and measures presented in Annex B, the key challenges addressed and considered in the scenario of achievement of objectives, i.e. the scenario of additional policies and measures that concern security of supply, greenhouse gas emission reductions, low carbon technology penetration in the electricity generation and the final consumption, and energy efficiency in all end-use sectors.

Taking into account the specific challenges, the objectives achievement scenario meets the national targets under the EU policy:

i. **The share of RES in gross final energy consumption for the year 2030 is estimated at 35%.**

ii. **Final energy consumption for the year 2030 is estimated to be significantly lower than the 2007 forecast and the reduction achieved amounts to 38% compared to the respective forecasts, while a corresponding reduction of 43% is achieved in primary energy consumption.**

iii. **The reduction in non-ETS greenhouse gas emissions is estimated at 36% in 2030 compared to 2005, the set objective being at 16%.**

Most of the key assumptions made for the individual parameters that affect the development of the energy system are identical to those of the scenario of existing policies and measures. However, the development of the costs of RES technologies is differentiated, while, in addition, it is accepted that the electricity infrastructure development plan is extended to include the interconnection of Southern Cyclades Islands, the Dodecanese Islands and the North Aegean Islands over the next decade (Table 34). In addition, the objectives achievement scenario, incorporates a set of new policies and measures as described in detail in Chapter 3 per subject, which shall be taken into account in the resolution process to capture the development of the energy system from the simulation model.

Table 34: Assumptions incorporated in the energy simulations of the electricity infrastructure development programme.

Internal Interconnections	Year of interconnection
Interconnection of Cyclades	
Stage A-C: Includes the electricity systems of Siros, Paros (including also Naxos, Antiparos, Koufonisi, Schinousa, Iraklia, Ios, Sikinos, Folegandros) and Mykonos (including also Dilos and Rinia)	2018-2020
Phase D: Other Cyclades Islands (Western and Southern)	2023-2024: Interconnection 2025: Year of full operation
Interconnection of Crete	
Phase I: 150kV, 2x200 MVA	2020: Interconnection 2021: Year of full operation
Stage II: The HETS undertakes all the load of Crete	2022: Interconnection 2023: Year of full operation

Interconnection of Dodecanese Islands	2027: Interconnection 2028: Year of full operation
Interconnection of North Aegean	2028: Interconnection 2029: Year of full operation
International Interconnections	
2nd Interconnection with Bulgaria, 600 MW	2023

4.3.2 Main characteristics of the energy system by 2030

The future picture of the energy system as illustrated by the **objectives achievement scenario** is illustrated by the evolution of the key energy figures that determine energy supply and demand in the period 2020-2030. The results presented below make clear that the development of the energy system varies significantly from the scenario of existing policies and the relevant energy and environmental objectives for 2030 are achieved both through changes in the mix of electricity generation and through large variations in fuel consumption in the final consumption sectors and at the level of energy efficiency achieved. Table 35 presents the evolution of key energy figures in the form of a concise balance, for the period 2020-2030, with intermediate years 2022, 2025 and 2027 to better monitor the effort made to achieve the national targets, as well as the evolution of specific energy and climate indicators over the same period. It also presents the years 2035-2040, assuming that no further policy measures are applied for the post-2030 period. It is worth noting that the evolution of key figures, such as RES shares, emission reductions and energy efficiency improvements, are in line with the values presented in the NECP-2030 scenario of the Long-Term Strategy for 2050.

Table 35: Concise energy balance and indicators based on the results of the objectives achievement scenario

Concise Energy Balance [ktoe]	2020	2022	2025	2027	2030	2035	2040
Primary Energy Generation	**5799**	**5468**	**6031**	**6696**	**7021**	**8145**	**9128**
Solid fuels	2180	1140	960	940	1	2	2
Petroleum products	281	332	408	459	536	536	536
Natural Gas	21	28	48	48	64	64	64
RES	3317	3969	4615	5249	6420	7543	8526
Net import	**19985**	**19272**	**18440**	**17740**	**17406**	**16366**	**15907**
Solid fuels	158	161	137	140	152	179	186
Petroleum products	13774	13292	12742	12403	11612	11125	10647
Natural Gas	5230	5074	4784	4426	4800	4238	4230
Electricity	533	444	425	409	394	411	429

Bioenergy	290	301	351	362	448	413	415
Seagoing Shipping	**1931**	**2003**	**2111**	**2162**	**2237**	**2369**	**2516**
Gross domestic consumption	**23853**	**22737**	**22360**	**22274**	**22190**	**22142**	**22519**
Solid fuels	2339	1301	1097	1080	153	181	188
Petroleum products	12124	11620	11039	10701	9912	9292	8667
Natural Gas	5250	5101	4832	4474	4864	4302	4294
Electricity	533	444	425	409	394	411	429
RES	3608	4270	4966	5611	6868	7956	8942
Fuel consumption in electricity generation	**6605**	**5066**	**4331**	**4055**	**3671**	**3562**	**3959**
Lignite	2178	1139	959	938	0	0	0
Petroleum products (incl. refineries)	746	534	431	360	140	120	90
Natural Gas	3608	3309	2816	2375	2666	1929	1763
Bioenergy	72	85	125	164	322	394	410
Geothermal heat	0	0	0	217	542	1119	1695
Net consumption by refineries	**236**	**235**	**232**	**229**	**226**	**220**	**214**
Consumption by refineries	31696	31540	31072	30760	30291	29510	28730
Refinery output	31460	31305	30840	30530	30065	29290	28515
Energy industry consumption	**1602**	**1593**	**1583**	**1578**	**1574**	**1523**	**1500**
Petroleum products	1443	1435	1414	1400	1379	1344	1308
Electricity	100	94	100	101	103	104	107
Bioenergy	59	63	69	78	92	76	86
Net electricity generation by thermal plants	**3018**	**2610**	**2295**	**2054**	**1835**	**1526**	**1529**
Lignite	698	447	390	390	0	0	0
Petroleum products (incl. refineries)	309	234	190	163	71	66	57
Natural Gas	1974	1883	1648	1395	1574	1164	1089
Biomass - Biogas	37	46	66	84	135	184	213
Geothermal	0	0	0	22	54	112	169
Grid/Storage losses and self-consumption of electricity	**498**	**458**	**433**	**420**	**419**	**347**	**337**
Non-energy uses	**765**	**765**	**765**	**765**	**765**	**765**	**765**
Final energy consumption	**17336**	**17357**	**17406**	**17357**	**17384**	**17244**	**17208**
Final energy consumption without ambient heat	**16926**	**16789**	**16714**	**16590**	**16508**	**16227**	**16181**
Final energy consumption without international transport	**16291**	**16286**	**16297**	**16230**	**16232**	**16050**	**15975**
by sector							

Industry	3011	2984	2943	2928	2879	2930	2968
Residential	4691	4556	4480	4430	4465	4328	4253
Tertiary	2177	2239	2331	2376	2451	2576	2643
Transport	6997	7108	7163	7121	7066	6887	6815
Agriculture	459	471	487	502	523	523	529
by sector (without ambient heat)							
Industry	3011	2984	2943	2928	2879	2930	2968
Residential	4572	4321	4211	4133	4130	3945	3895
Tertiary	1887	1907	1909	1907	1910	1942	1974
Transport	6997	7108	7163	7121	7066	6887	6815
Agriculture	459	471	487	502	523	523	529
by fuel							
Solid fuels	160	162	139	141	153	181	188
Petroleum products	9287	9004	8551	8299	7750	7190	6624
Natural Gas	1244	1386	1597	1672	1759	1933	2091
Electricity	4612	4571	4680	4712	4852	5143	5383
District heating	43	43	41	40	39	37	35
RES (direct use)	1580	1622	1705	1725	1955	1743	1860
Ambient heat	410	568	692	766	876	1018	1027

Indicators	2020	2022	2025	2027	2030	2035	2040
Total GHG emissions not inclusive of international air transport (Mt CO_2eq)	**82**	**73**	**69**	**67**	**61**	**58**	**55**
ETS Emissions	36	28	26	24	19	17	16
Non-ETS emissions	46	45	44	43	42	41	38
Emissions of CO_2 per sector (Mt CO_2)							
Electricity generation	22.6	15.1	12.7	11.4	6.6	4.8	4.0
Energy Sector	4.7	4.6	4.6	4.5	4.4	4.3	4.2
Industry (including the processes)	9.9	9.9	9.4	9.3	8.8	8.7	9.0
Residential	4.9	4.0	3.5	3.3	2.9	2.9	2.5
Tertiary/Rural	1.4	1.5	1.5	1.4	1.4	1.3	1.2
Transport	18.1	18.3	18.1	17.9	17.2	16.1	15.3
Other emissions (CO_2 emissions and other GHG) (Mt CO_2eq)	**20.0**	**19.8**	**19.5**	**19.4**	**19.3**	**19.6**	**18.6**
Total greenhouse gas emission intensity	3.4	3.2	3.1	3.0	2.7	**2.6**	**2.4**

($kt\ CO_2eq/ktoe$)							
RES share in gross final energy consumption [%]	**19.7%**	**23%**	**27%**	**30%**	**35%**	**38%**	**41%**
RES share in final consumption for heating and cooling [%]	**30.6%**	**34%**	**37%**	**38%**	**43%**	**43%**	**43%**
RES share in gross electricity consumption [%]	**29.2%**	**39%**	**47%**	**53%**	**61%**	**70%**	**72%**
RES share in final consumption for transport [%]	**6.6%**	**7%**	**10%**	**12%**	**19%**	**29%**	**41%**
Energy Dependency [%]	**78%**	**78%**	**75%**	**73%**	**71%**	**67%**	**64%**
Energy productivity [million EUR '10/ktoe]	**8.39**	**9.18**	**9.91**	**10.37**	**11.03**	**12.20**	**13.12**
Primary consumption of energy per inhabitant [toe/resident]	**2.16**	**2.07**	**2.05**	**2.05**	**2.07**	**2.10**	**2.17**

Specifically, for the year 2030, the objectives achievement scenario marks a **GHG emission reduction of almost 43% in 1990 and 56% in 2005** with total emissions falling to 61 Mt CO_2eq levels (Chart 12). It is worth pointing out that this rate of reduction goes even further than the respective central European targets, and as presented in the next section, the simulation of the PRIMES energy model shows prospects for an even greater rate of reduction.

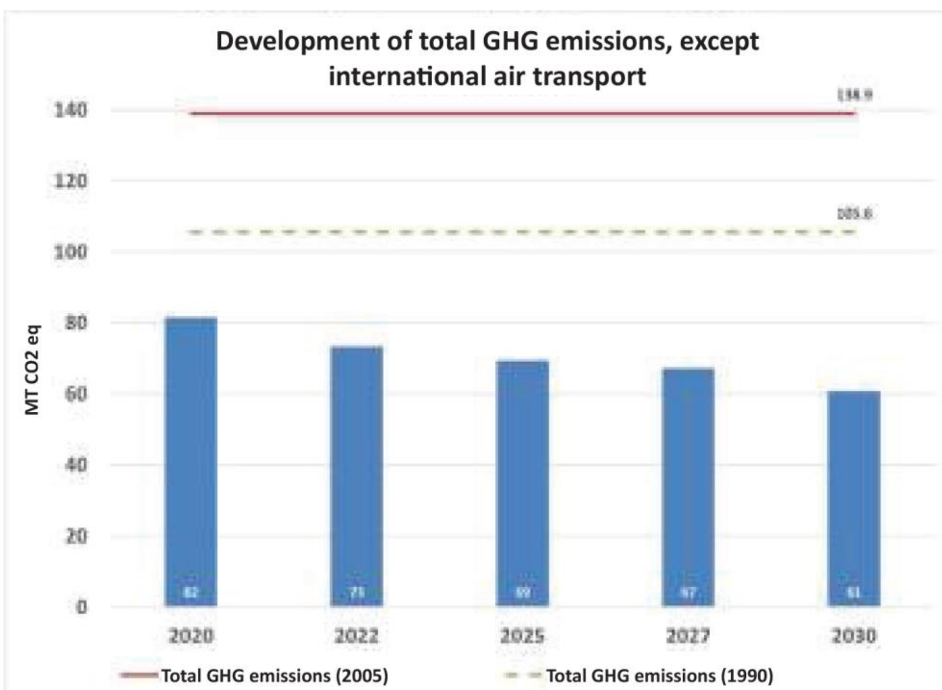


Chart 12: Evolution of total greenhouse gas emissions by 2030, for the objectives achievement scenario.

Respectively, the reduction target for greenhouse gases emissions other than the EPC is achieved at a significantly higher level in relation to the mandatory EU reduction target for Greece (16% reduction in 2030 compared to 2005, i.e. 54.8 Mt CO_{2eq}), as they are expected to decrease to 41.7 Mt CO_{2eq} in 2030, as shown in Chart 13. It should be noted that greenhouse gas emissions from the domestic air transport sector as well as the part of the ETS international air transport have been counted in the ETS sectors.

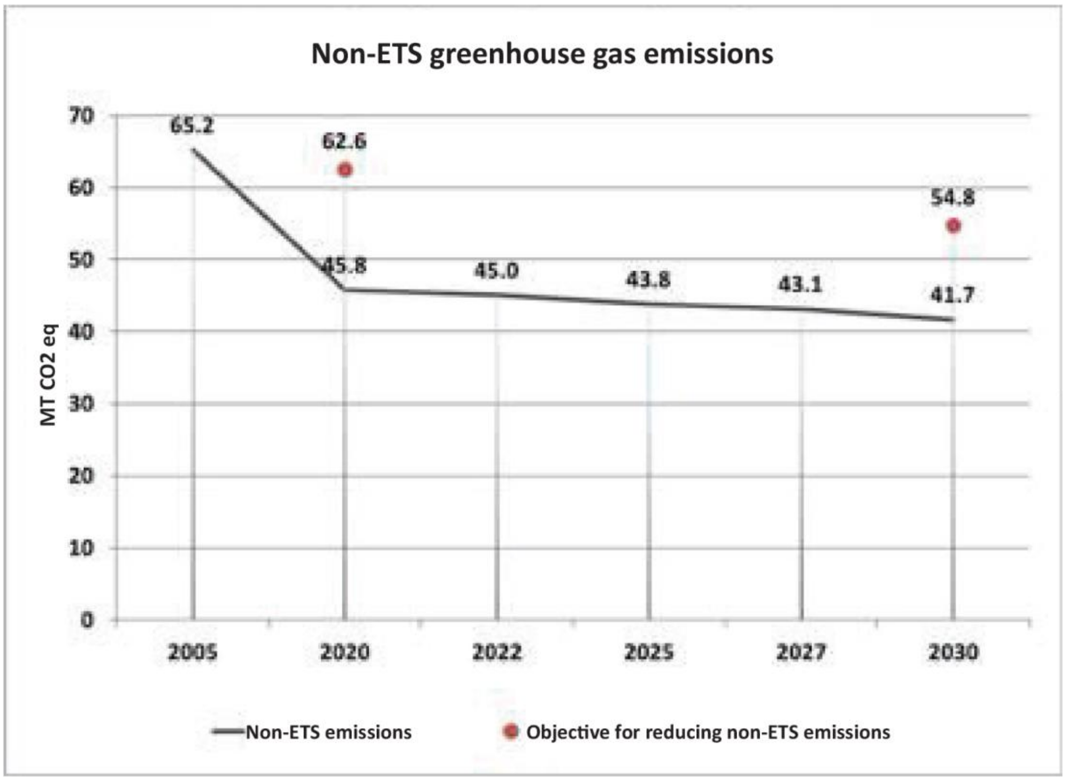


Chart 13: Development of greenhouse gas emissions outside the EU ETS until 2030 taking into consideration the objectives achievement scenario.

Accordingly, in the sectors within the ETS, there is an even greater reduction of emissions compared to the European target set for 2030. In particular, when the target for ETS emissions reduction is 43% for 2030 compared to 2005, a decrease of 74% is finally achieved and the emissions are reduced in absolute figures to 18.9 Mt CO_2eq, as shown also in Chart 14.

In particular for CO_2 emissions in Greece in 2030, compared to 2005, there is a reduction in the sectors of electricity generation, the energy sector other than electricity generation, industry, including industrial processes, the residential sector, and a modest decline in the transport sector. On the contrary, there has been a stabilisation in the CO_2 emissions of the tertiary and agricultural sectors in the same period. However, the total CO_2 emissions for 2030 are estimated at 41.3 Mt of CO_2 compared to 115 Mt CO_2 in 2005, with the highest decrease being observed in the electricity generation sector (88% decrease in 2030 compared to 2005) (Chart 15). As in the case of existing policies and measures, the total reduction of emissions is achieved by the choice of cleaner forms of energy in all sectors and in particular in the sector of electricity generation, where, as described also below, a percentage of more than 22% of high technology CO_2 emissions (i.e. lignite and petroleum plants) is replaced by electricity generation from RES in 2030. In parallel, the intensity of the CO_2 emissions for those sectors shows a significant decrease of 49% in 2030 compared to 2005.

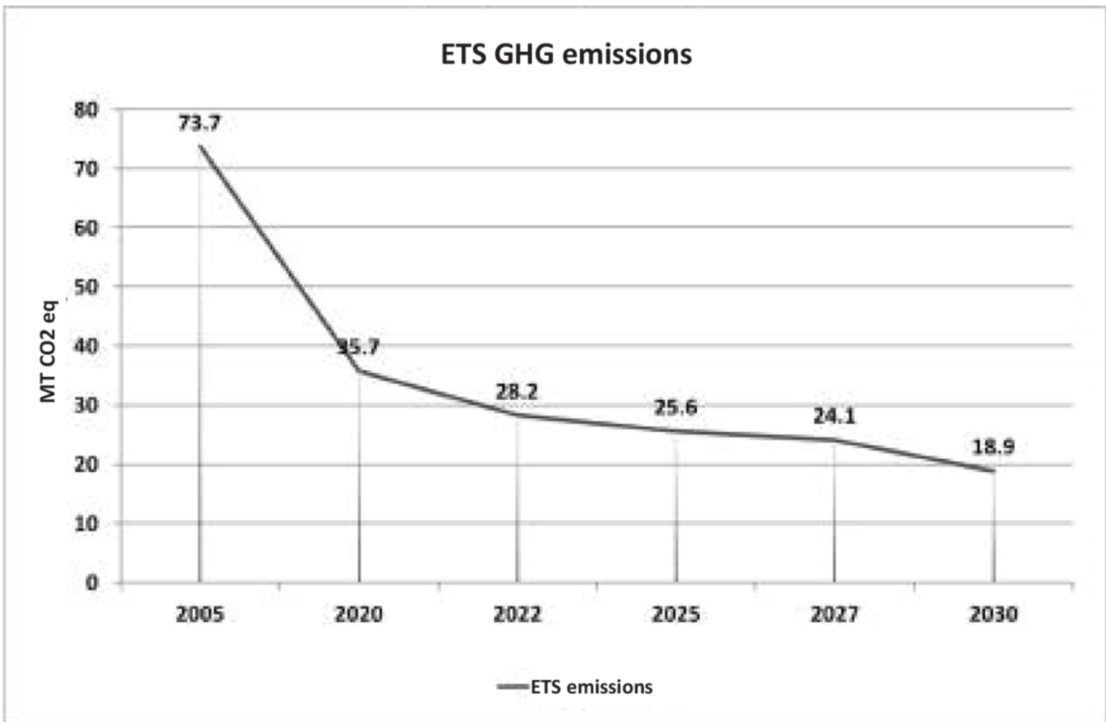


Chart 14: Development of greenhouse gas emissions included in the ETS until 2030 taking into consideration the objectives achievement scenario[19].

Accordingly, the total greenhouse gas emissions intensity shows a significant decrease of around 20% in 2030 compared to 2020, highlighting the achievement of a future energy mix of lower greenhouse gas emissions (Chart 16).

[19] Does not include emissions from the aviation sector.

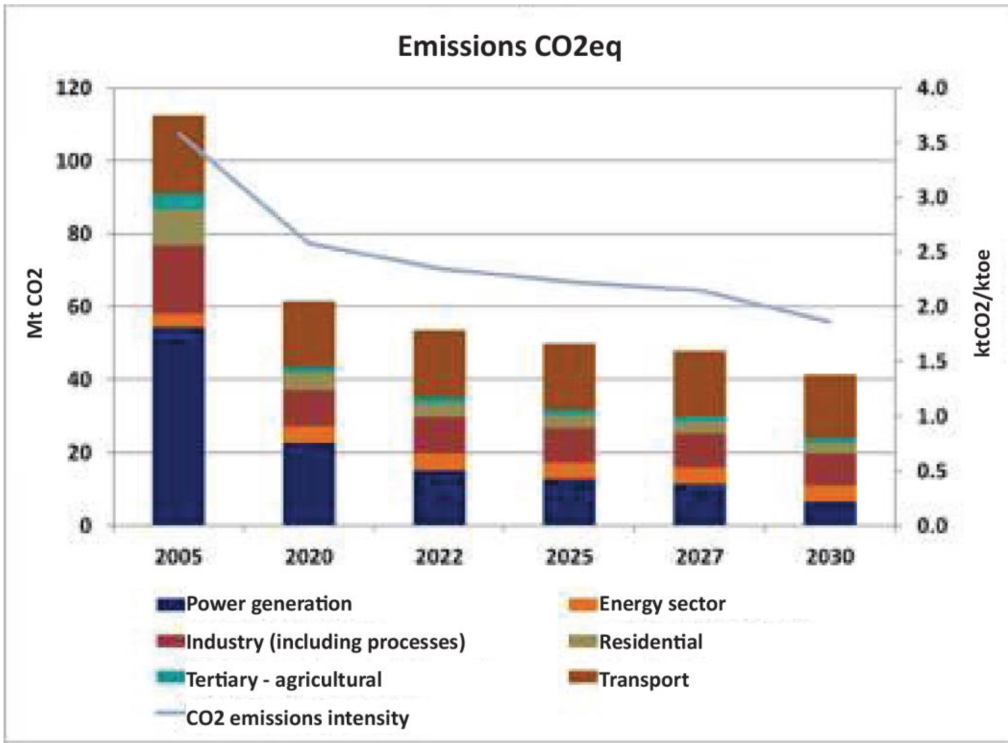


Chart 15: Development of CO_2 emissions until 2030 taking into consideration the objectives achievement scenario.

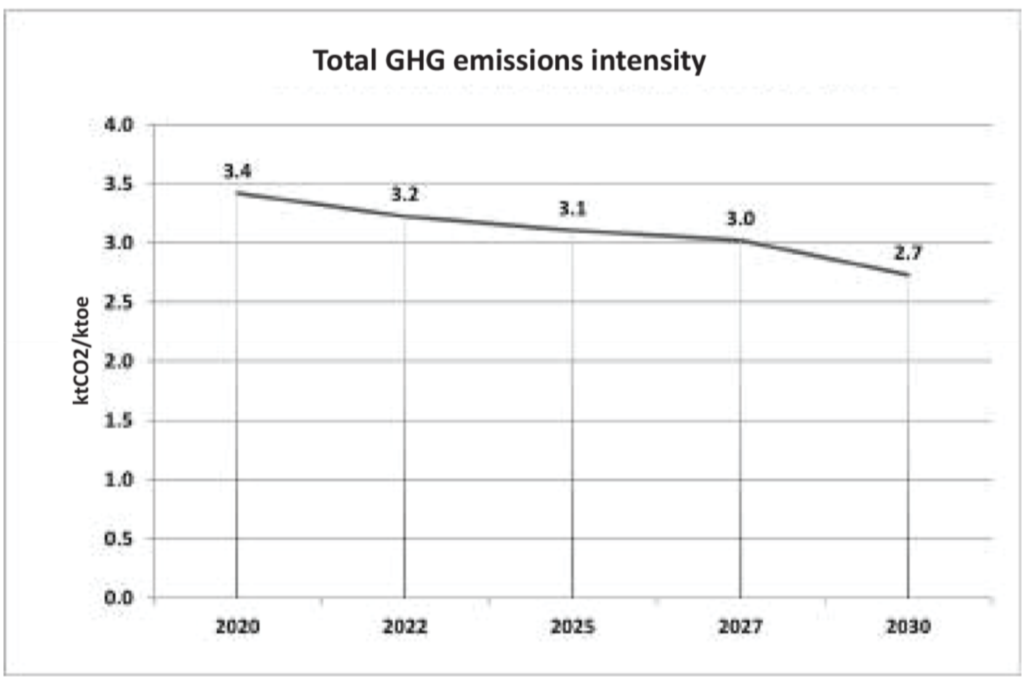


Chart 16: Development of total gas intensity until 2030 taking into consideration the objectives achievement scenario.

Regarding productivity in relation to energy consumption, Chart 17 illustrates the change in energy intensity in relation to the evolution of GDP. It is observed that while GDP is projected to show a gradual and steady growth throughout the period 2020-2030 (average growth rate of 10% and 11% for the five year periods 2021-2025, 2026-2030 respectively), the energy intensity in the objectives achievement scenario follows a significant downward trend, being reduced by 24% in 2030 compared to the year 2020 levels, which highlights the significant **decoupling of economic growth from gross domestic energy consumption**. It is worth noting that this also results from the analysis made in the energy simulation of the PRIMES model, the second model used in parallel with the TIMES model for the preparation of the NECP. Specifically, according to the results of the PRIMES model and taking into account the same assumptions for the evolution of macroeconomic indicators, energy intensity is reduced by 32% between 2020 and 2030, which confirms the conclusion that economic growth is decoupled from gross domestic energy consumption.

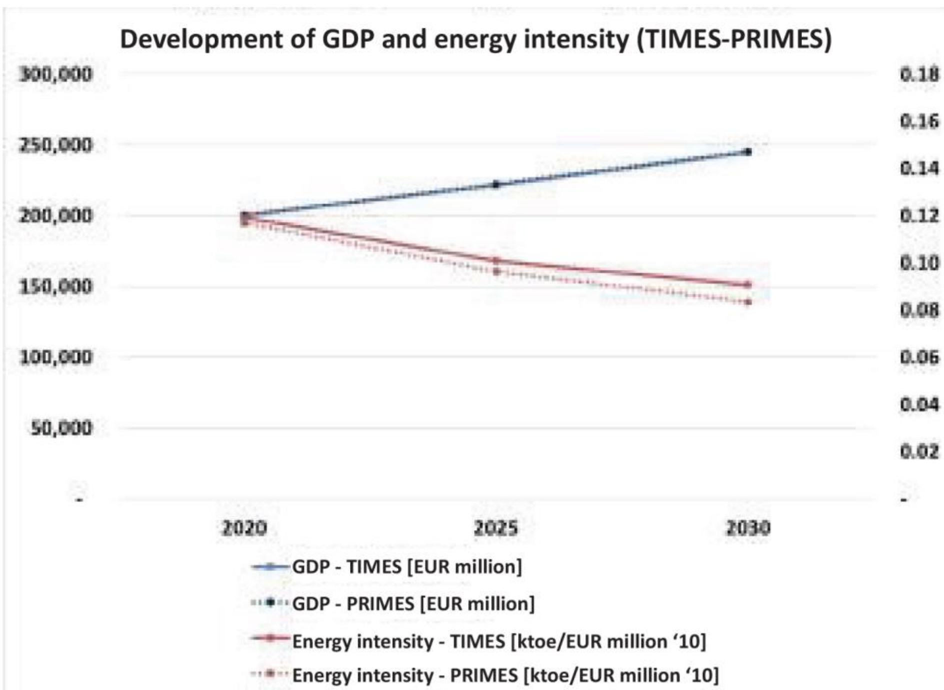


Chart 17: Development of GDP and energy intensity by 2030, for the objectives achievement scenario.

<u>*RES participation*</u>

Chart 18 shows the evolution of RES penetration by 2030. According to these results, the revised target for the year 2030 is achieved in relation to the original NECP plan, as the corresponding **share of RES in gross domestic consumption is estimated to reach or exceed 35%**. It is also noted that the commitment made for RES share in gross domestic energy consumption for 2020 is achieved as the contribution share is estimated at 19.7% for 2020, instead of the targeted 18%, and the corresponding target for a 20% contribution share is approached.

Chart 19 presents the shares of the three components that form the total contribution of RES in gross final consumption of energy (i.e. the contribution of RES to electricity generation, the contribution of RES to final consumption to heating and cooling and finally, the contribution of biofuels to the final consumption for transport) for 2020 and 2030. The greatest share of RES contribution for the year 2020 corresponds to heating and cooling (50%), while for the year 2030 it corresponds to electricity generation by 54%. It is noted that in capturing these shares, electricity from RES is only included in electricity generation and not as consumption in transport, so that it is not double-counted.

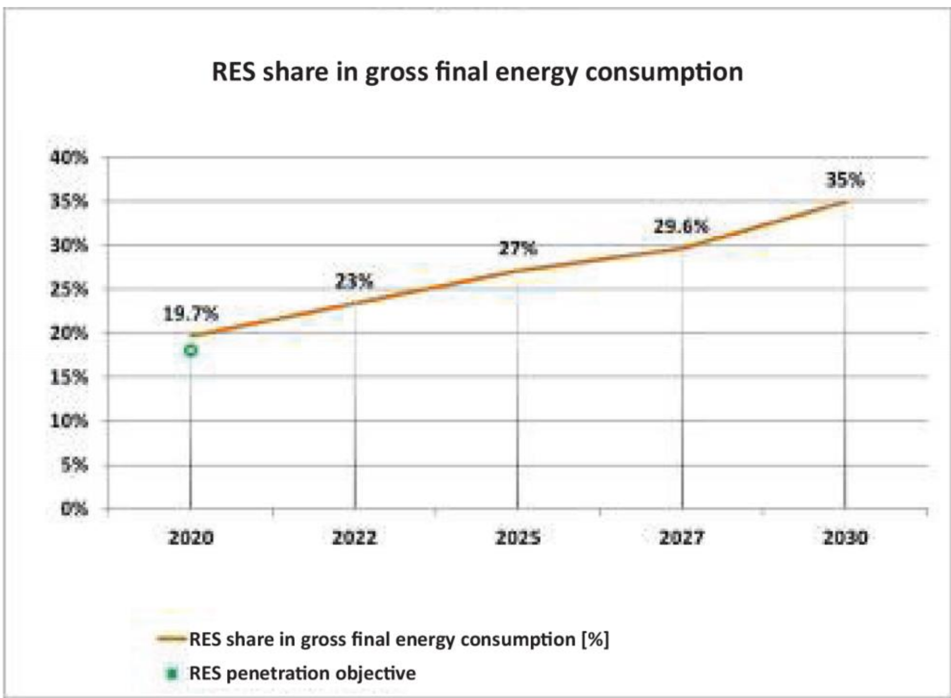


Chart 18: Development of market penetration of RES in gross final consumption of energy until 2030 for the objectives achievement scenario.

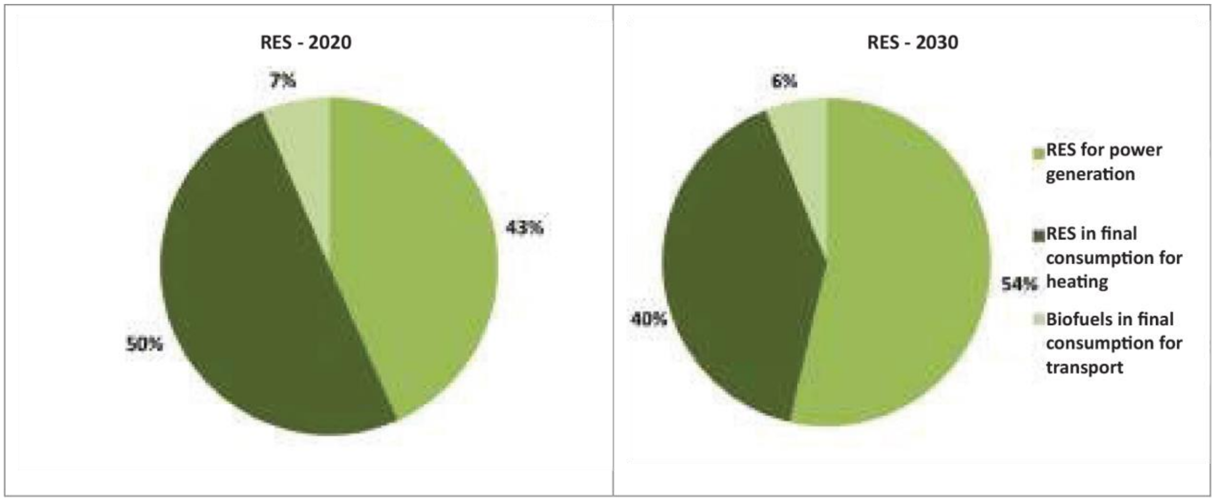


Chart 19: RES share per sector in total RES penetration in gross final consumption of energy in 2020 and 2030 in the objectives achievement scenario.

In particular, Chart 20 shows the development of the RES penetration in gross final consumption of electricity, which amounts to 61% for 2030 with the utilisation of all commercially mature technologies, while this percentage was 24,5% in 2017. The participation of RES in gross final consumption of electricity doubled in 2030, compared to 2020, with an average annual growth of around 3.2 percentage points, indicating the **fundamental change in the national electricity generation mix and its shift towards RES**.

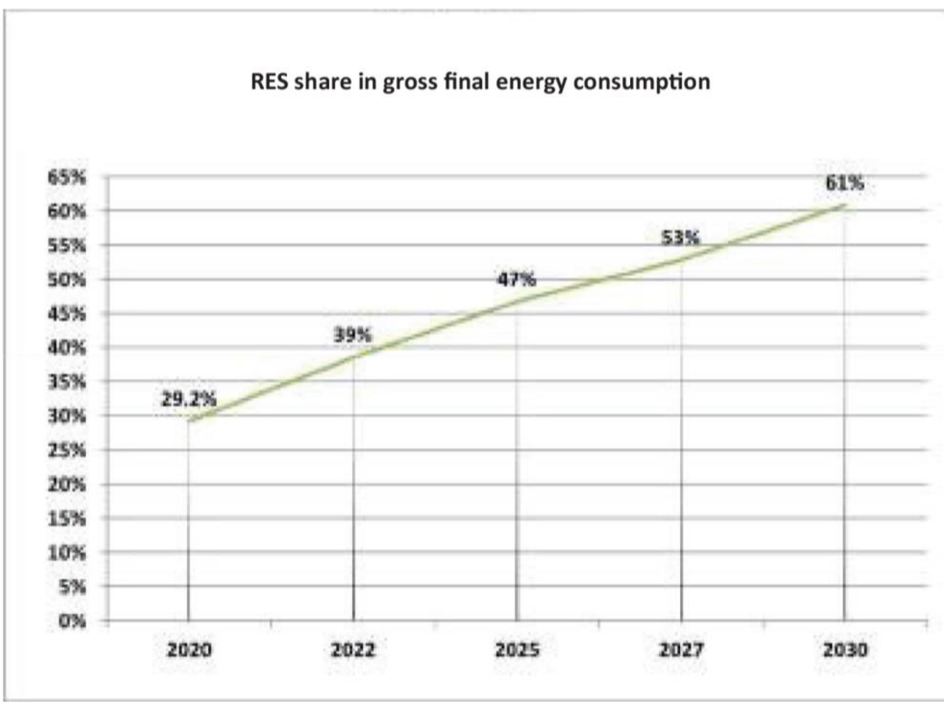


Chart 20: Development of market penetration of RES in gross final consumption of electricity until 2030 for the objectives achievement scenario.

The development of the RES penetration in the final consumption for heating and cooling in the objectives achievement scenario is presented in Chart 21, where that percentage is increased significantly in 2020-2030 and amounts to approximately 43% in 2030 with an average increase of almost 1.2% per year, which is mainly due to the significantly increased market penetration of heat pumps for covering the needs for heating and cooling in the tertiary and the residential sector, the maintenance of the use of biomass at high levels, the increased use of thermal solar systems in the residential sector, as well as the use of RES (biomass, geothermal systems) in district heating networks.

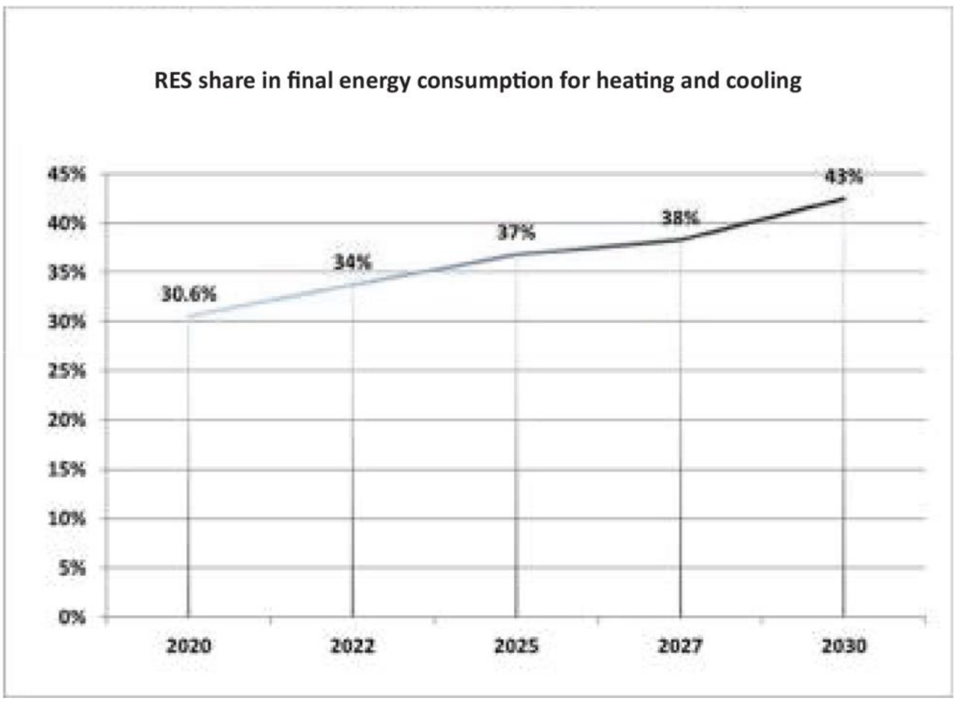
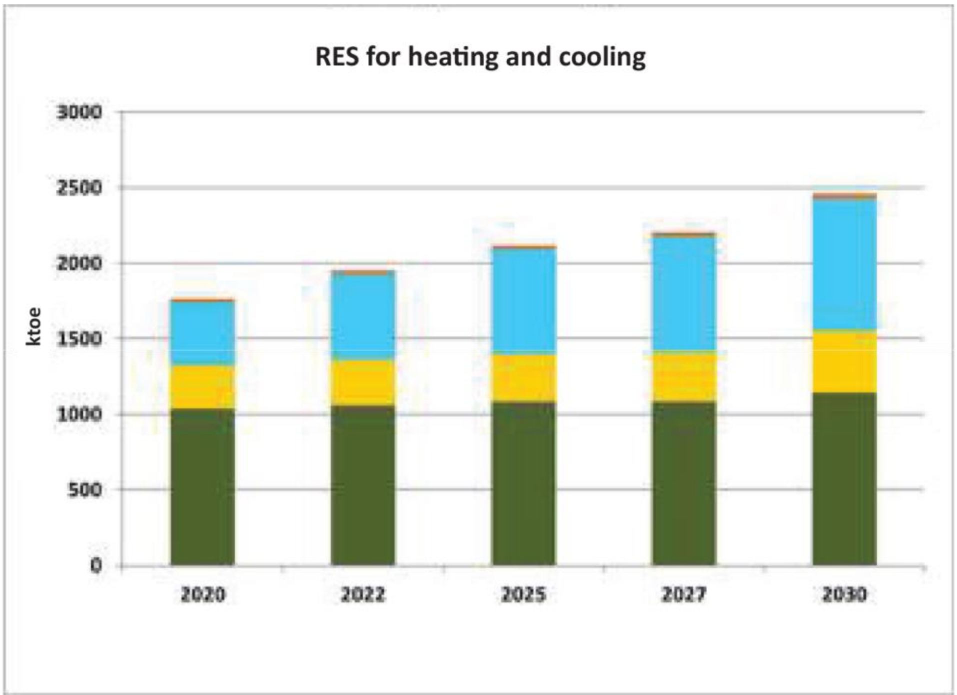


Chart 21: Development of market penetration of RES in the final consumption of energy for heating and cooling until 2030 for the objectives achievement scenario.

As shown in Chart 22, the use of bioenergy (primary solid biomass) will continue to make a significant contribution to heating and cooling, but without a significant increase until 2030, mainly due to the reduction of its use in the urban centres on environmental grounds. Thermal solar systems will continue to have a significant share, mainly for domestic hot water heating in the building sector, increasing significantly in absolute figures, but their share in total final consumption is not expected to be significantly differentiated by 2030. The use of heat pumps for heating purposes is expected, also in the objectives achievement scenario, to play the most decisive role in RES penetration in the final consumption by 2030 with their market share in the contribution of RES for heating purposes amounting to 36% in 2030.



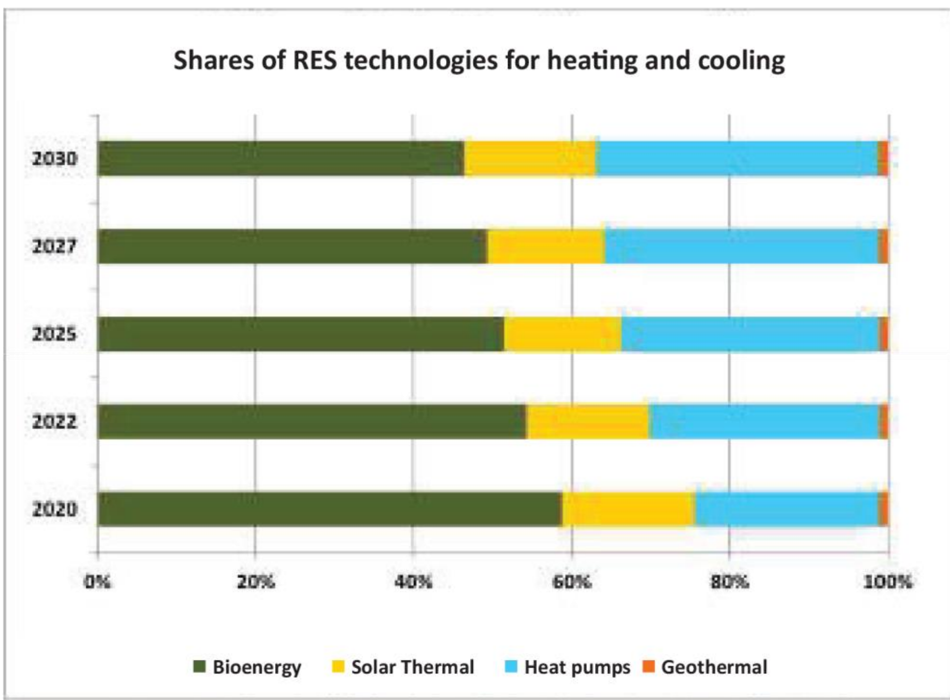


Chart 22: Development of RES shares for heating and cooling in the final consumption of energy until 2030.

Finally, the transport sector is characterised by fast increase of the RES share, mainly due to the penetration of biofuels and the considerable contribution of electricity, which is generated from RES to a great extent, as analysed in the following paragraphs.

Thus, in line with Chart 23, RES penetration in the final consumption of energy for transport will be 19% by 2030, as calculated according to the revision of Directive (EU) 2018/2001 for the promotion of RES, with the actual share (without multipliers) standing around 10%.

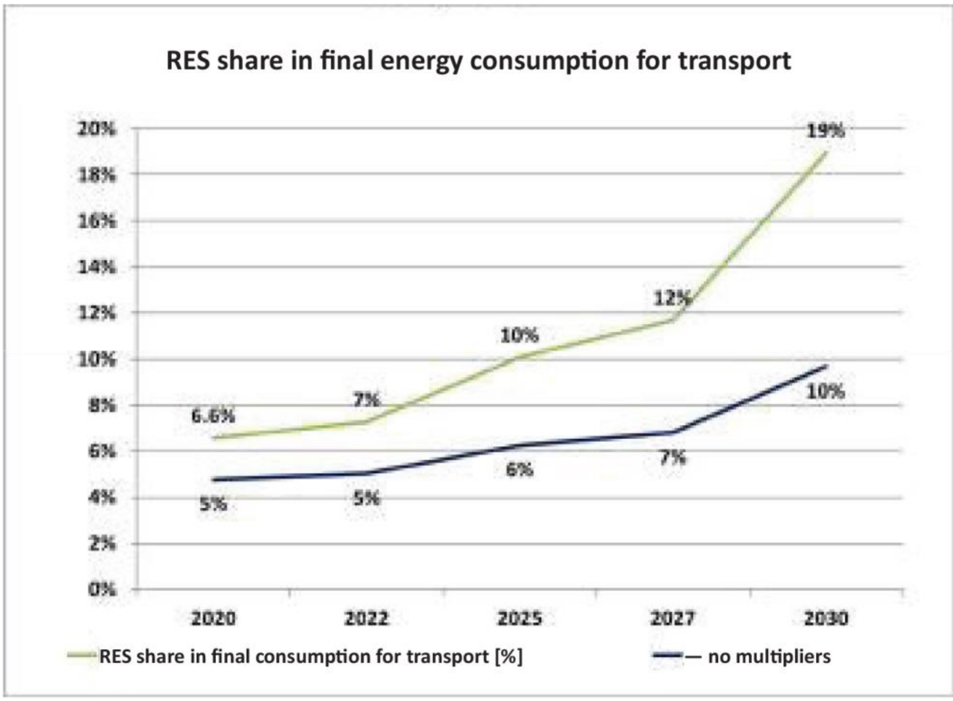


Chart 23: Development of market penetration of RES in the final consumption of energy for transport until 2030 for the objectives achievement scenario[20].

Chart 24 shows the contribution of biofuels and electricity to the share of RES in transport. The contribution of biofuels, including multipliers related to the use of advanced biofuels, is increased by 5 percentage points from 2020 to 2030, while without the use of multipliers the increase is 3 percentage points. Respectively, the contribution of electricity to the corresponding multipliers for road and rail transport multipliers increases by 7 percentage points over the same period, while without the use of multipliers, the increase in electricity contribution is limited to 2 percentage points.

[20] The RES share in transport has been calculated as provided for in the revision of Directive (EU) 2018/2001 on the promotion of RES, and includes specific multipliers for the contribution of advanced biofuels and electricity from RES and a restriction on the contribution of first generation biofuels.

Specifically, the use of electricity in road transport (including electric vehicles) is projected to reach 0.13 Mtoe in 2030, which contributes by 6.7% to the share of electric vehicles with a multiplier of 4 corresponding to electric vehicles, while the contribution of electric rail transport is estimated to be 0.02 Mtoe, which with the corresponding multiplier of 1.5 contribute to the share of RES in transport by 0.4%.

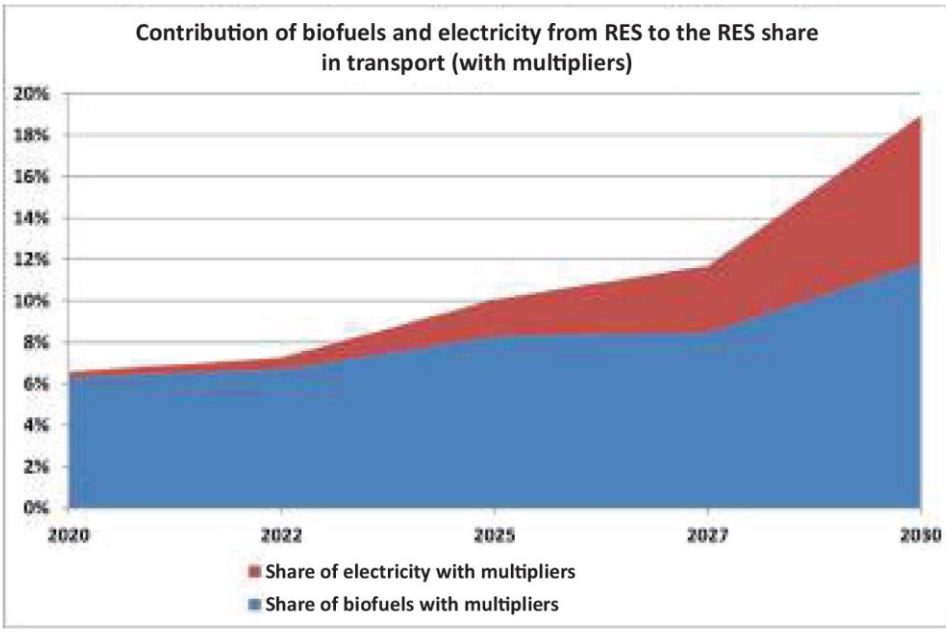


Chart 24: Contribution of biofuels and electricity from RES to the share of RES in transport by 2030 for the objectives achievement scenario.

Table 36 presents the evolution of the contribution of advanced biofuels to the target of RES penetration in transport. It is noted that the contribution of advanced biofuels is counted for two in accordance with Directive (EU) 2018/2001.

Table 36: Evolution of the contribution of advanced biofuels to the target of RES penetration in transport

Advanced biofuels (in accordance with Part A of Annex IX to Directive (EU) 2018/2001)	2020	2022	2025	2027	2030
Consumption (ktoe)	81	94	127	127	197
Contribution to the target of RES penetration in transport	3.3%	3.8%	5.1%	5.2%	8.2%

Energy consumption

In terms of energy demand, total primary energy consumption shows a mild but steady decline by 2030, while, especially for 2020 and 2030, consumption is lower than both the national target for 2020 (24.7 Mtoe), as well as the overall European target for 2030[21] (a 43% decrease over the 2007 forecast for 2030), as shown in Chart 25. Moreover, based on the results of the energy simulations, it is estimated that primary energy consumption will be reduced by 17% in 2030 compared to the national target of 2020 (24.7 Mtoe).

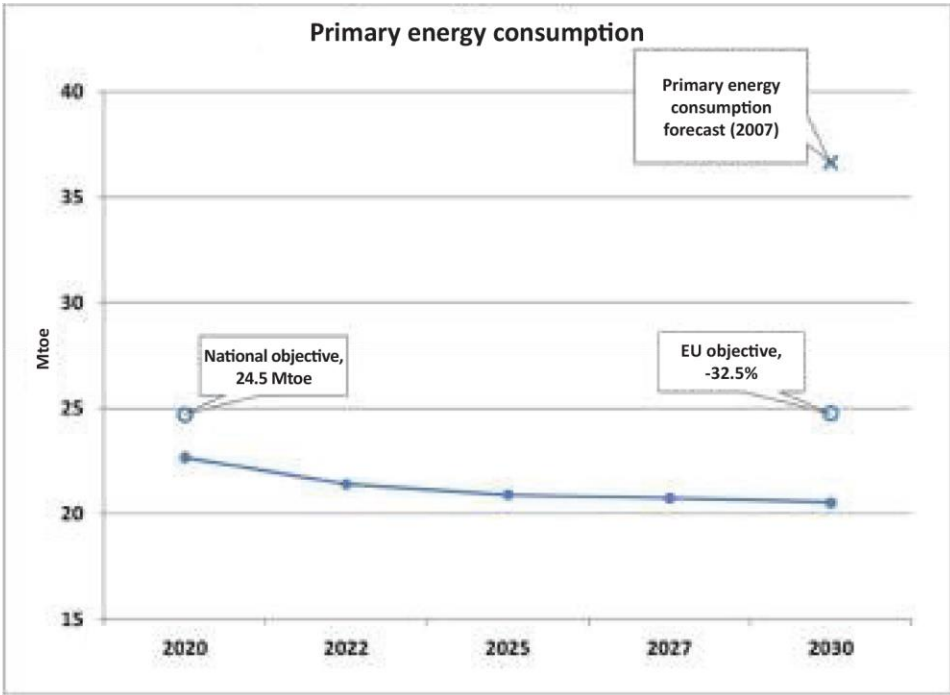


Chart 25: Development of primary energy consumption until 2030.

At the same time, there is a modest reduction in final energy consumption which is expected not to exceed 16.5 Mtoe in 2030, i.e. lower than in 2017, demonstrating the achievement of higher energy efficiency through the adoption of stronger measures and policies, mainly in the building sector but also in the transport sector. As shown in Chart 26, in 2020 it is estimated that the final consumption of energy will be 5% lower than the respective national objective, while for 2030 the reduction of the final consumption of energy for 2030 is more than 32.5% that was predicted in 2007 and **reaches 38%**. In addition, it is estimated that final energy consumption will be reduced by 10% by 2030 compared to the national target of 2020 (18.4 Mtoe).

[21] It should be noted that the European energy efficiency target is defined as lower primary and final consumption by 32.5% in 2030 than the corresponding forecasts in 2007 for 2030.

It is noted that these figures are presented without the contribution of ambient heat consumed by the use of heat pumps, to be compared with the corresponding forecasts for 2007.

It is also worth noting that the difference between primary and final energy consumption declines in the period 2020-2030, which demonstrates the improvement of the energy efficiency of the system through the penetration of RES mainly in power generation.

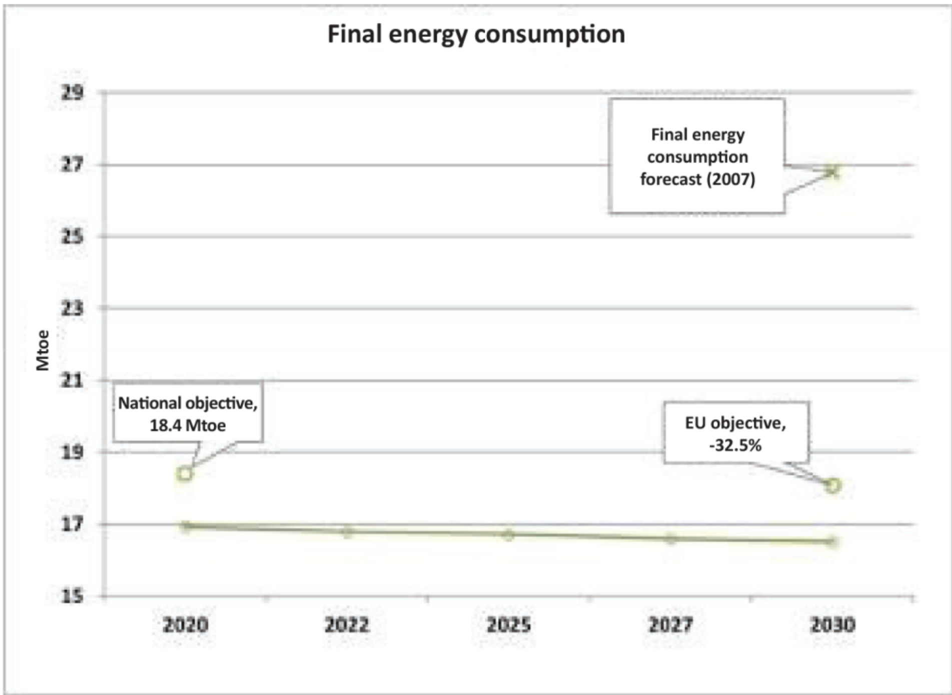
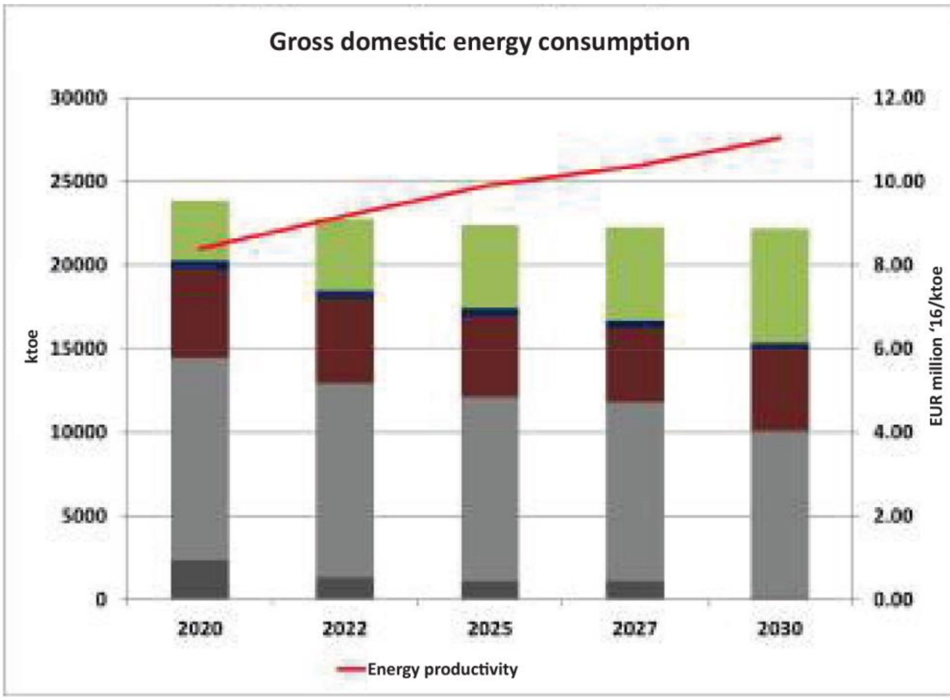


Chart 26: Final energy consumption evolution by 2030.

In the energy system in total, gross domestic consumption of energy declines, which results in a significant improvement of the cost-efficiency of the energy sector, as shown by the development of the energy productivity indicator (Chart 27).

In particular, energy productivity shows an **increase of 31% in 2030 compared to 2020**. At the same time, there is a higher RES penetration, which is almost double in the period 2020–2030, while the share of solid fuels is significantly reduced, mainly due to the lignite phase-out of the electricity generation sector. Meanwhile, petroleum products are significantly reduced due to the withdrawal of the islands' oil-producing plants after their interconnection with the interconnected system and the replacement of the use of petroleum products in the sectors of final energy consumption (buildings, transport) from RES and natural gas.



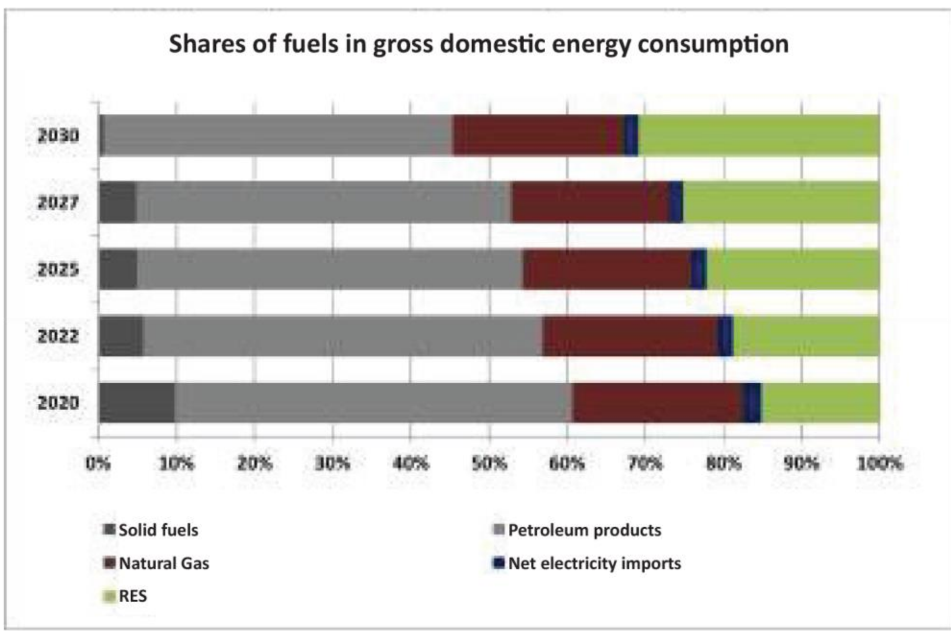
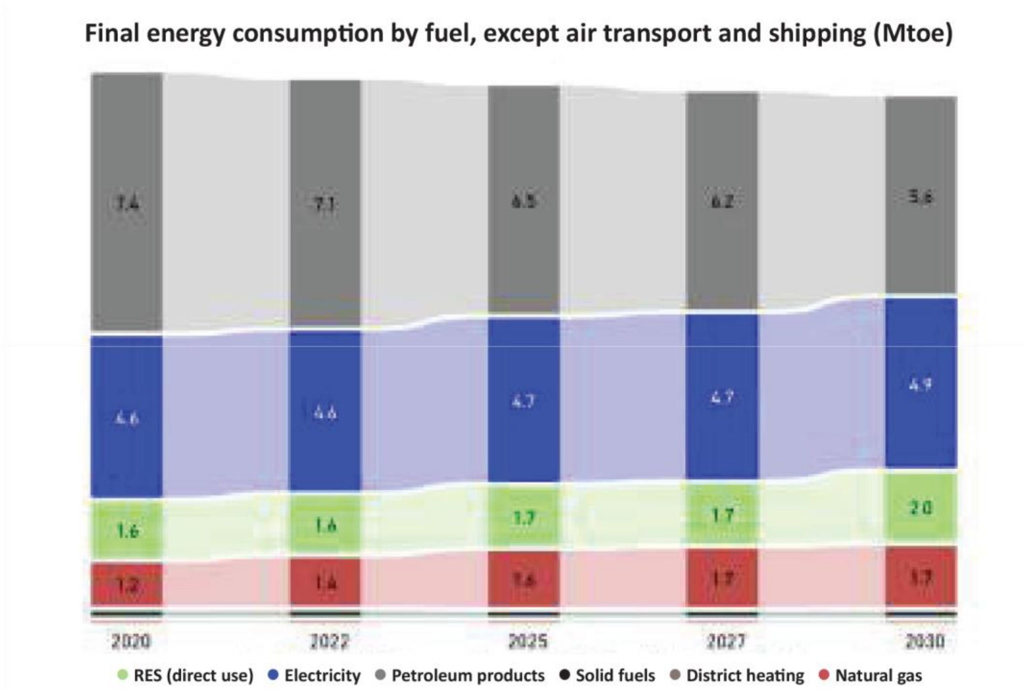


Chart 27: Development of fuels shares in the gross domestic consumption until 2030 for the objectives achievement scenario.

Final energy consumption declines by 2.5% in 2030 compared to the estimate for 2020 and by 1.5% compared to 2017, while total energy consumption is reduced to 16.5 Mtoe (not including ambient heat for the use of heat pumps) (Chart 28).



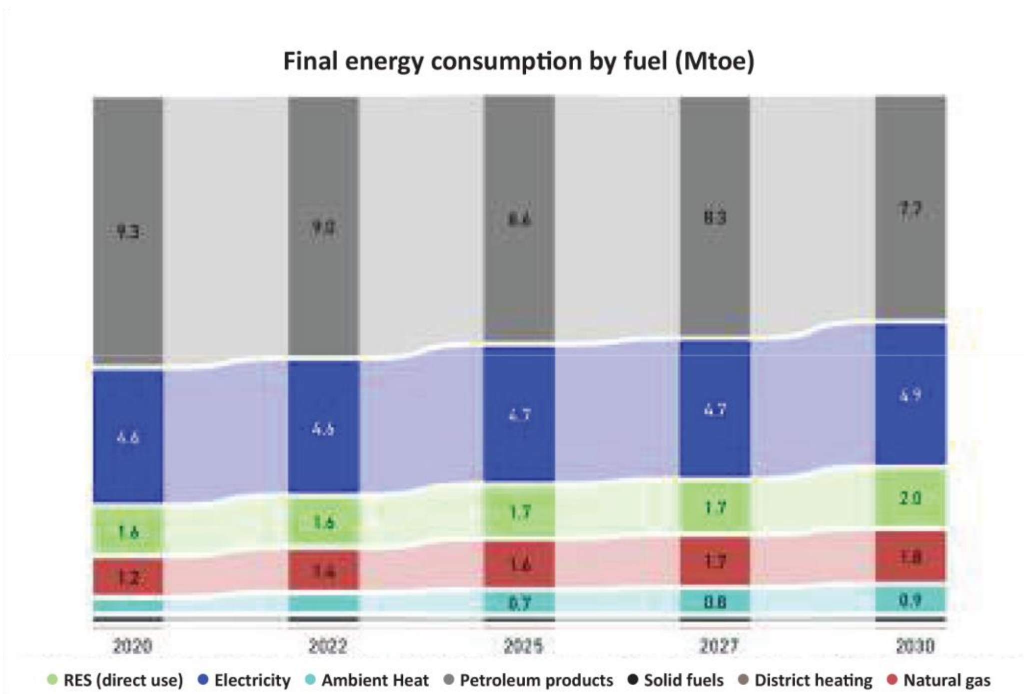


Chart 28: Development of the shares of the final consumption of energy fuels until 2030 (a. excluding aviation and navigation, b. total FEC).

Regarding final energy consumption including ambient heat for the use of heat pumps, it remains at almost constant levels throughout the years 2020-2030.

In parallel, there is a 42% increase in the direct use of RES in the final consumption of energy (i.e. thermal solar, geothermal, heat pumps, bioenergy) in 2030 compared to 2020, with a significant decrease in the direct use of oil products and a significant rise of the direct use of natural gas. The district heating remains stable and its share in the total is very low, amounting to 0.2% in 2030 (Chart 28). The total final consumption of energy includes also the consumption of the sub-sectors of transport related to aviation (national and international) and domestic shipping in respect of which there are limited opportunities to improve their energy efficiency for the reference period.

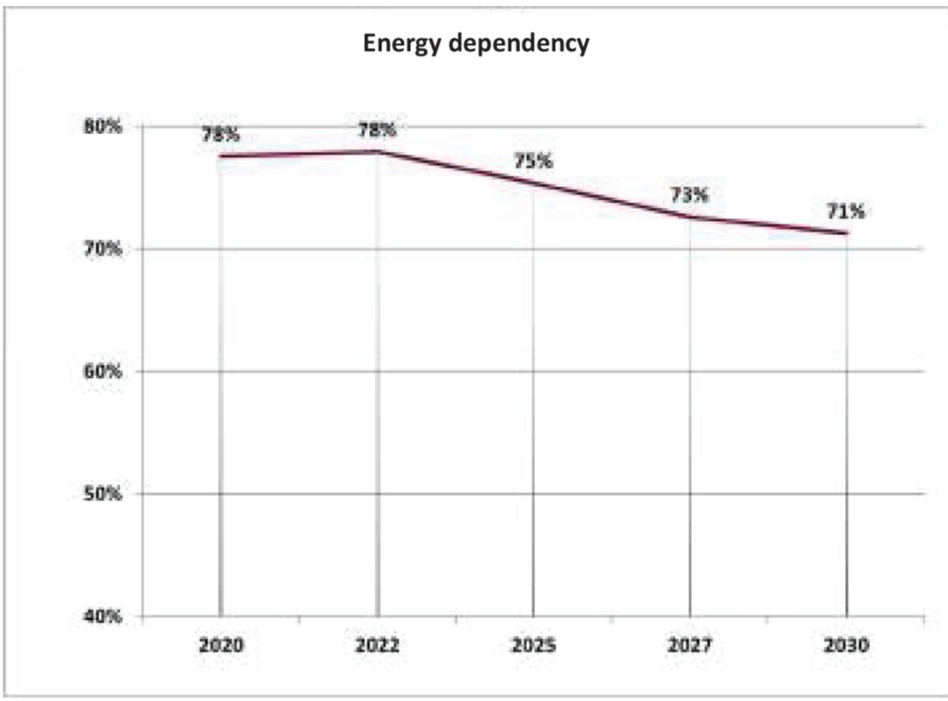


Chart 29: Development of energy dependency by 2030.

With regard to the energy dependency of the country from fuel imports, there is a moderate but significant variance of the specific indicator, achieving a percentage of reduction of 7 percentage points in 2030 compared to 2020 (Chart 29). This result is largely due to the high penetration of RES in the national energy mix and the significant improvement in end-use energy efficiency, which as shown in the chart above, which over-counter the cessation of domestic lignite use in power generation.

4.3.3 Evolution of the interconnection of the Greek electricity system

The following Table 37 calculates the level of interconnection and the indicators of the urgency of the action for the Greek Electricity System for the year 2020 as well as for the years 2025 and 2030, in accordance with the policy priorities for the competitiveness of the domestic electricity market, as presented in the corresponding Chapter 2.6. Estimates only take into account planned or ongoing new interconnection projects (2nd Greece-Bulgaria interconnection, interconnection with Cyprus), and the results of the energy simulations regarding the projected installed power generation, electricity demand and installed power of electricity from RES.

With regard to national interconnection targets set by the European Directive, the Greek interconnected electricity system is projected to meet the target of the 10% interconnection level set for 2020, and will also meet the 15% target of future planned interconnection projects before 2025 (mainly due to the completion of the 2nd Greece-Bulgaria interconnection), i.e. earlier than the target year of 2030. It is also expected that, by 2025, on the basis of planned or ongoing new interconnection projects, the 30% criterion set for the indicators of urgency of the action under Directive (EU) 2018/1999 on the Governance of the Energy Union and Climate Action and amending previous Regulations and Directives, will be met.

Table 37: Level and indicators of interconnection of the Greek electricity system

Year	2020	2025	2030
Interconnectivity level	13%	21%	21%
Rated Capacity / Peak Load	18%	43%	48%
Rated Capacity / Installed RES Power	18%	34%	31%

4.3.4 Evolution of electricity generation

The evolution of the electricity generation system by 2030 is marked by a significant penetration of RES and the withdrawal of lignite plants by 2028, which is planned under the new national policy on lignite phase-out of the energy sector, and the reduction in installed capacity of the oil plants, which are expected to be decommissioned on the one hand due to the high emissions of gaseous pollutants and the age of these plants and on the other because of the impending power interconnections of the islands to the interconnected system during the period under consideration. The essential characteristics of the electricity generation system until 2030, in line with the objectives achievement scenario, are presented in Table 38.

Table 38: The essential characteristics of the electricity generation system until 2030, in line with the objectives achievement scenario.

Electricity generation	2020	2022	2025	2027	2030
Installed capacity [GW]					
Lignite	3.9	2.9	0.7	0.7	0.0
Petroleum products (incl. refineries)	1.9	1.7	1.0	1.0	0.3
Natural Gas	5.2	6.0	6.9	6.9	6.9
Bioenergy	0.1	0.1	0.1	0.2	0.3
Hydro (incl. mixed pumping)	3.4	3.7	3.8	3.9	3.9
Wind farms	3.6	4.2	5.2	6.0	7.0
Photovoltaics	3.0	3.9	5.3	6.3	7.7
Solar thermal	0.0	0.0	0.1	0.1	0.1
Geothermal	0.0	0.0	0.0	0.0	0.1
Total	**21.1**	**22.6**	**23.1**	**24.9**	**26.2**
Power of new central storage systems	**0.7**	**0.7**	**1.4**	**1.4**	**1.4**
Gross electricity generation [GWh]	54386	54424	55681	56109	57927
Self-consumption	2007	1602	1398	1276	708
Net Electricity Generation [GWh]	**52379**	**52822**	**54283**	**54833**	**57220**
Lignite	8114	5199	4536	4538	0
Petroleum products (incl. refineries)	3597	2723	2209	1892	828[22]
Natural Gas	22963	21894	19169	16229	18304
Bioenergy	425	539	772	974	1575
Hydro	5453	6410	6528	6581	6596
Wind farms	7280	10090	12610	14398	17208
Photovoltaics	4548	5967	8202	9712	11816
Solar thermal	0	0	257	258	260
Geothermal	0	0	0	252	631
Net electricity imports [GWh]	6200	5165	4946	4752	4578
Grid/Storage Losses [GWh]	3785	3728	3635	3611	4165

[22] It concerns almost exclusively power generation of the energy sector in refineries

Total electricity supply [GWh]	58579	57986	59228	59586	61797
Energy sector consumption [GWh]	1158	1093	1164	1169	1201
Final electricity consumption [GWh]	53636	53165	54430	54805	56431
Contribution of RES in gross electricity generation	32.6%	42.3%	50.9%	57.3%	65.7%
CO_2 emissions from Electricity Generation [Mt CO_2]	23	15	13	11	7

RES penetration into the gross domestic product mix in 2030 is expected to reach a share of almost 66%, from 32.6% in 2020, due, on the one hand, to the expected further reduction in the cost of RES technologies for electricity generation, especially photovoltaic and wind power plants and, on the other hand, to the withdrawal of lignite plants, the production of which they are called upon to replace. The expected increase in the production costs of the remaining conventional plants, due to the increase in the cost of acquiring emission allowances, makes RES particularly competitive with conventional plants for the period after 2020.

New RES technologies for their energy utilisation

The development and utilisation of innovative RES technologies, which can contribute to the further exploitation of the domestic potential, is expected to play an important role. In this regard, new applications and technologies for renewable electricity generation, as well as other applications enabling them to expand their use and utilise existing energy infrastructure, are already being evaluated and promoted.

In the coming period, priority will be given to utilising the **geothermal potential** for electricity generation**,** to developing a viable market for **small wind turbines** contributing to both scattered production and increased domestic value added as well as **marine wind parks** with corresponding multiple combining benefits for the energy system, the grids and the national economy. Similarly, initially mainly through pilot applications, the development of projects for the energy utilisation of **wave energy** and of **RES hydrogen production** will be promoted. To this end, the corresponding legislative and regulatory framework for the operation of these projects should also be developed, and it is extremely important to develop or update, where necessary, the necessary support schemes and mechanisms for their operation.

Equally important are the opportunities for coupling the sectors through the injection of **biomethane** into the gas network, applications for **storage** by converting electricity into renewable gas, and the development of **desalination** systems using RES.

Moreover, the objective of RES penetration in gross final energy consumption is achieved in the most cost-effective manner for national economy, through the significant increase of the contribution of wind power stations and solar parks in electricity generation. This is because these technologies already entail a very low weighted average cost of electricity generation, directly competitive market-wide with conventional thermal power plants in the short term.

It is noted that part of the petroleum plants on the islands which will be interconnected will continue to exist, mostly on cold standby. However, their operation will be considerably limited as, on the one hand, the electric charge of islands will be mainly covered by the interconnected system and, on the other hand, the implementation of the IED and MCPD Directives will be decisive in determining the maximum number of hours of operation.

In particular, the total installed capacity for electricity generation in 2030 is 26 GW, up by 38% compared to 2017, mainly due to the high penetration of uncontrolled RES plants, as uncontrolled RES have a lower utilisation rate in relation to conventional thermal power plants. The installed capacity of lignite-fired power plants is not taken into account in 2030, as the last year with lignite-fired electricity generation is 2028, while the installed capacity of petroleum plants is expected to decline by 85% in the year 2030 compared to 2017, reaching 0.3 GW.

Overall, the installed capacity of RES is increasing slightly less than 9 GW by 2030, compared to 2020, with more than 90% of this increase involving wind farms and photovoltaic parks (Chart 30). It is noted that depending on the energy simulation of the two energy models, the technologies selected and the rate of utilisation of these projects, the additional new RES capacity for the period 2020-2030 is estimated at 8 GW to 9 GW. Specifically for photovoltaics, the broadening of their use has also been integrated at distribution network level, especially in urban and semi-urban areas, through energy offsetting schemes and projects by energy communities. The doubling of the installed capacity of bioenergy plants, which is expected to reach and exceed 0.3 GW of installed capacity by the end of 2030 with the simulations of both energy models, is of particular interest.

With regard to the shares and amounts of installed capacity of both thermal power generation plants and RES technologies, it is noted that they have been determined in the context of energy simulation, taking into account specific assumptions regarding the reduced cost of electricity generation by such plants and they should be considered indicative and possible, but not binding, at technology and project category level. Specifically regarding RES electricity generation plants, and taking into account the context of competitive tendering procedures and the development of cost reduction in electricity generation, therefore, the possibility of developing such procedures outside the support system, the final distribution of the power of such projects on a technological level may be differentiated significantly by 2030.

Therefore, more than anything, the requirement for electricity generation from RES must be treated as an objective and rely on the market and the individual advantages between RES technologies, to assess which power will finally contribute to this objective. Accordingly, as regards thermal power plants, this approach must also not be binding and the operating margin for plants, whether new or not, must be determined depending on the needs of the liberalised and competitive electricity market.

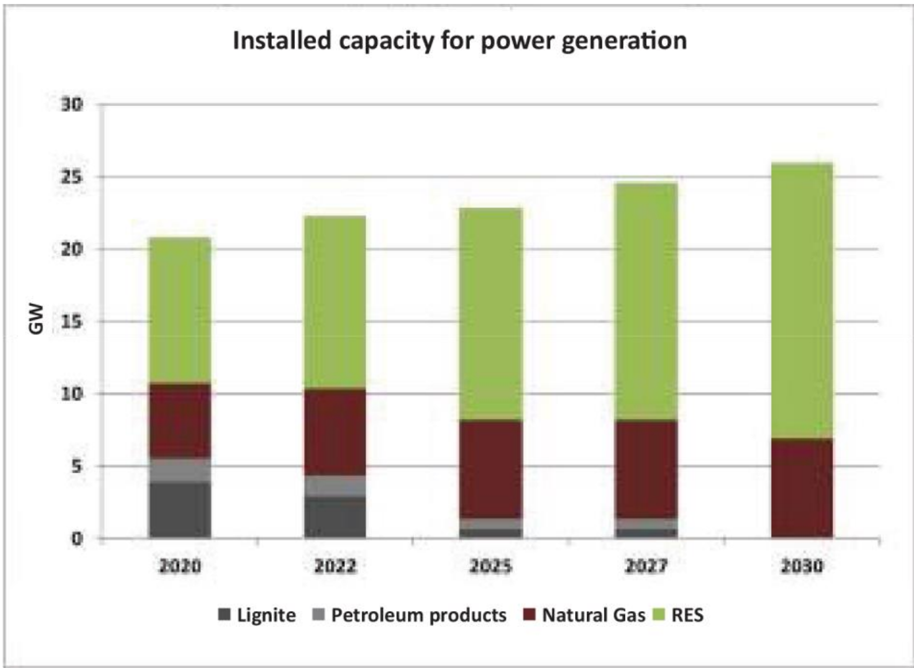


Chart 30: Evolution of installed capacity of electricity generation plants until 2030.

More specifically, regarding the contribution of RES to electricity generation, it is estimated that uncontrolled RES (wind power stations and solar parks) shall increase for the year 2020 to 6.5 GW, and to 14.7 GW for 2030. It is estimated that 800 MW of cumulative new power from wind power stations and solar parks will have to be installed on average every year. Regarding the installed capacity of the hydroelectric power plants, it is projected to increase by about 430MW during the period 2020-2030, due to the operation of major hydroelectric projects, as well as through the development and operation of a number of new small hydroelectric projects. Correspondingly, the installed bioenergy power is increased by more than 220 MW compared to 2017, while it is estimated that the penetration of solar thermal power stations and geothermics will be low (Chart 31).

In order to achieve high levels of uncontrolled RES penetration in the most economically efficient manner (sufficiently low cuts in their production), there is a need for energy storage (pumped storage hydropower, batteries, conversion into gas, etc.). Based on previous studies on the costs related to the mainland electricity generation system (such as the 2018 Ten-year Development Plan of ENTSO-E), the TIMES model considers that new storage systems are integrated in the years following 2025 (in addition to the existing hydroelectric power stations of Sfikia and Thisavros, which have a pumping capacity), the cost of which is estimated at around EUR 0.5 billion. The total energy transmitted to storage systems for the year 2030 is estimated to be up to 2.2 TWh. Specifically for storage needs, the PRIMES energy model has also analysed specific technologies and hourly uses of these storage systems by the year 2030, including the possibility to operate small decentralised storage systems (batteries) either autonomously or cumulatively. It is worth noting that by 2030 the first electrolysis systems are expected to operate, allowing the electricity generation sector to be coupled with the hydrogen generation sector for energy storage. These results of estimates of storage use by the PRIMES energy model are presented in Chart 32.

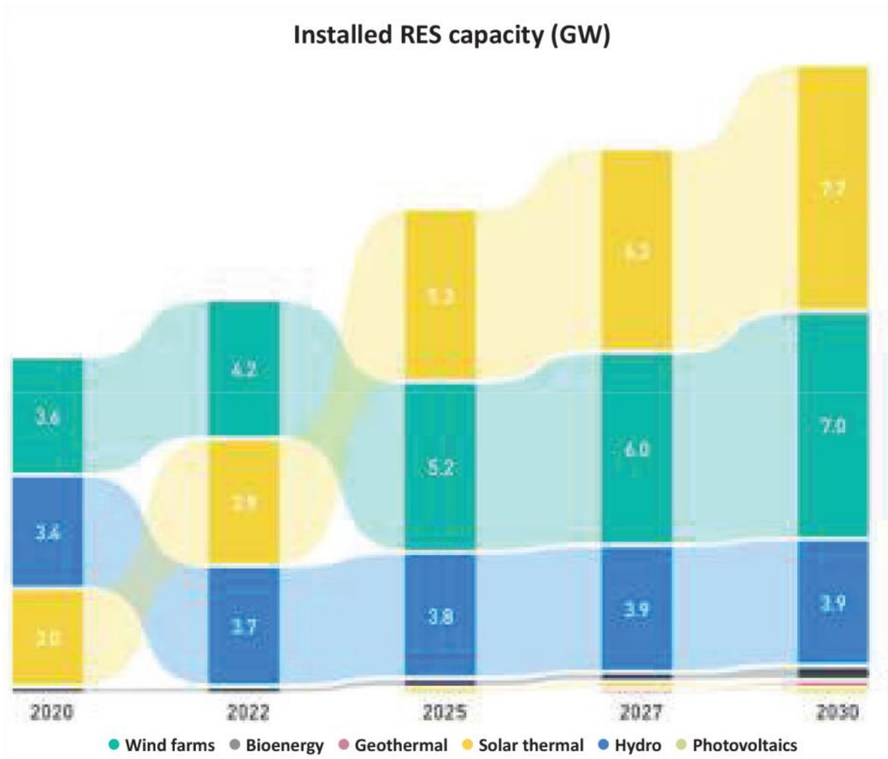


Chart 31: Evolution of installed capacity of electricity generating RES until 2030.

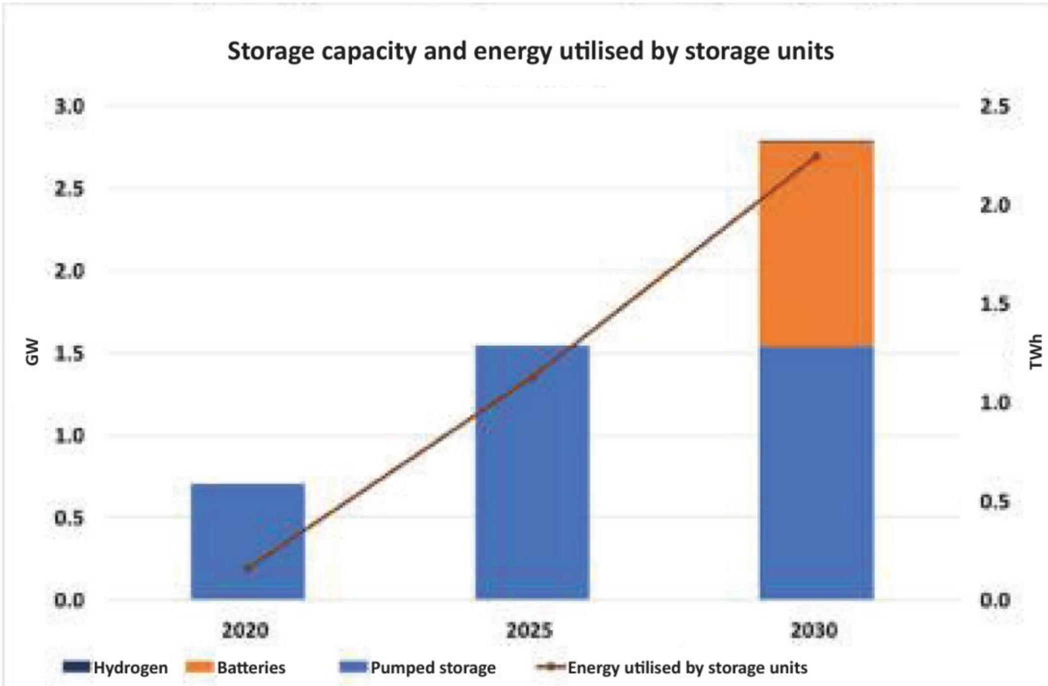


Chart 32: Evolution of installed power and energy for storage by the year 2030 according to the PRIMES energy model.

The provision for this new installed power from wind farms and solar parks, as shown in annual figures, reflects the size of the challenge to achieve the national objective regarding the participation of RES in the gross final consumption of electricity, but also as a whole. More specifically, although the required technical and financial potential is available, annual growth rates must be achieved for these technologies cumulatively over ten years, rates which have never been achieved in our country in the past, with the exception of the period 2011-2013, when they were achieved with a non-economically sound and, ultimately, non-sustainable, manner.

For the above reasons, it is necessary, in addition to achieving a reduction of the weighted cost of electricity generation from these technologies so that no operating support is required, to provide all necessary regulatory, technical and coordinating tools so that said growth may be achieved under transparent, continuous and unambiguous terms for all stakeholders and for the local communities where such new RES projects are carried out.

It is noted that in order to achieve the above figures in new installed power generated from wind farms and solar parks, and the highest possible utilisation rate, it is necessary to also examine gradually new opportunities at the level of technology applications (e.g. storage), as well as new categories of projects (e.g. marine wind farms), provided that it is deemed that the reduction in the cost of such applications and projects is sufficient so that the total new cost of electricity generation by such applications and projects remains at a low level and is directly competitive under electricity market rules. In this context, the relevant regulatory and operational framework for these projects should be developed.

At the same time, to include all these projects in the energy networks, it is important to examine the need to expand the networks for the distribution and transmission of electricity, as well as the timely scheduling of the expansions which will be deemed necessary from a technical and financial point of view. In any case, the majority of these projects are expected are expected to operate with full obligations for participation in the electricity market.

The simulation of the evolution of the energy system until 2030 also provides for the significant development of new PV projects at distribution network level, especially at low network voltage, as it is expected that more than 600 MW of such systems will be installed across the Greek territory, especially through the energy offsetting scheme, thereby further utilising gradually the possibilities provided for the use of these systems on a technological and regulatory level.

A specific reference should also be made to the new RES power expected to be installed by plants with fully distributed electricity generation features (i.e. stations exploiting geothermal fields, biomass and biogas), which are expected to quadruple their current installed capacity by 2030. These plants are necessary for the proper functioning of the domestic electric system, also taking into account the expected large figures of electricity generation from uncontrolled RES, so that they may also function as compensation charges when necessary. The development of this category of electricity generation from RES is an additional challenge to the development of the energy system, because it requires optimal coordination at local level both at the stage of licensing and construction, and at the stage of the operation of such plants, and these specific plants have the highest domestic added value among RES technologies during the time of their operation.

The challenges for the development of small hydroelectric projects are equally significant, as the installed power of such projects is expected to increase, on the basis of a steady growth rate, over the next decade and until 2030, thus contributing greatly to the significant contribution of RES to gross electricity consumption. Specially regarding projects subject to multiannual licensing procedures, the existence of a clear, continuous framework is necessary for this category of projects to achieve such participation figures.

As shown in Chart 33, the total net electricity generation, including imports in the country, increases in relation to that in 2020 by 5.5% until 2030 and is gradually based on ‘cleaner’ sources (the share of imports is reduced to 7% of the total electricity for distribution). Specifically for the year 2030, net lignite power generation will have no share at all, while for the year 2020 it is estimated that approximately 14% of power generation will still come from lignite fuel plants.

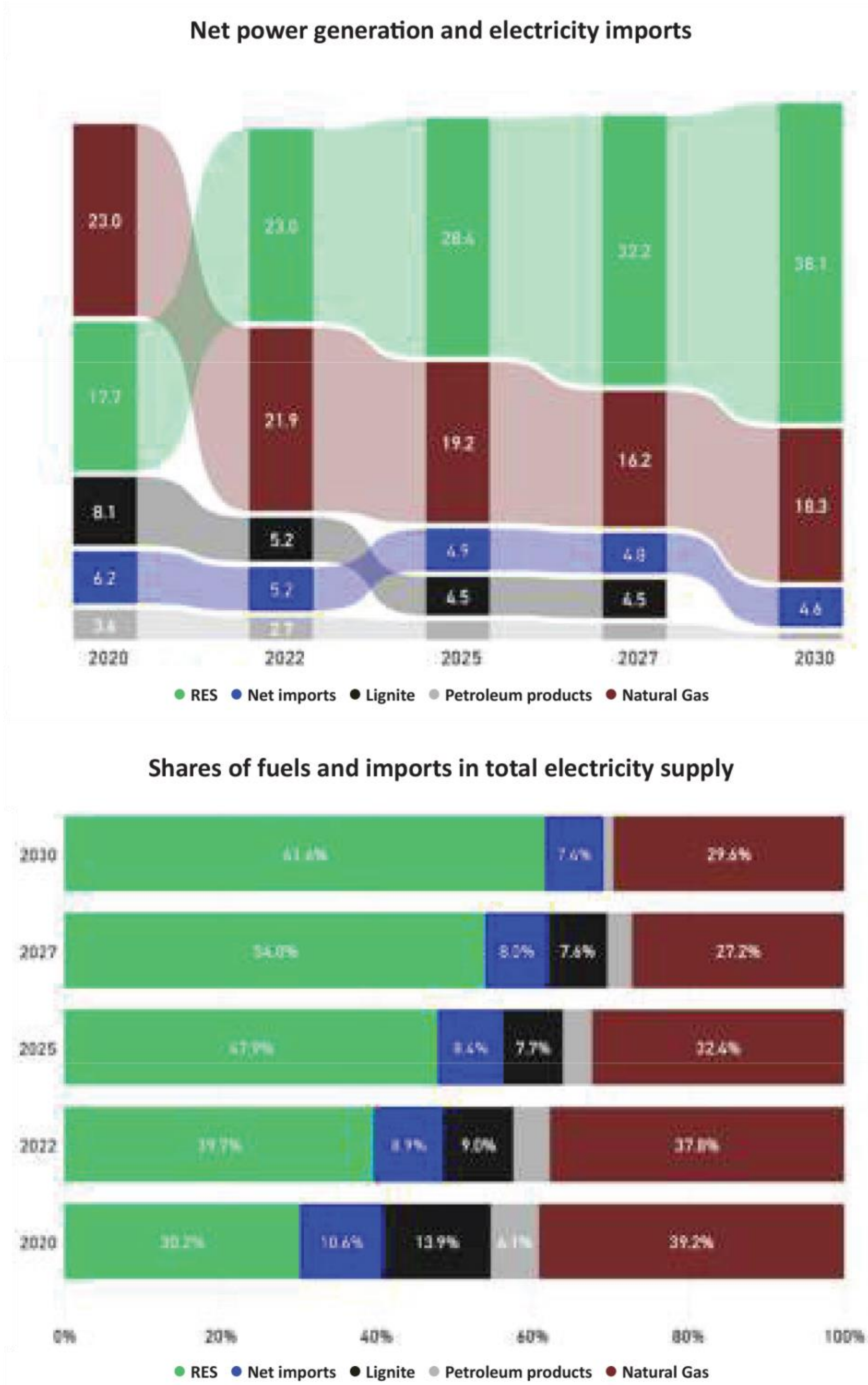


Chart 33: Evolution of net electricity generation and imports until 2030.

Accordingly, the share of petroleum products in electricity generation shall be reduced substantially, i.e. by 77% in 2030 compared to 2020, mainly due to the withdrawal of petroleum plants currently installed on non-interconnected islands, following their interconnection with the mainland system. A little generation from petroleum products of around 1% of total net generation, which is still observed in 2030, relates almost exclusively to electricity generation in refineries.

Gas in electricity generation decreases by almost 20% in 2030 compared to 2020. In general, it is estimated that during the period 2020-2025 natural gas production will present the highest absolute electricity prices and corresponding shares in the total domestic electricity generation. The retention of the relatively significant shares of natural gas in electricity generation by 2030 (> 30%) is also due to its enhanced role as distributed generation technology following the total withdrawal of lignite-fired power plants.

Specifically for RES, as shown in Chart 34, electricity generation from wind and photovoltaic power plants will more than double in 2030 compared to 2020, while the share of bioenergy (biomass, biogas and bioliquids) in electricity generation will increase almost six-fold.

The increase of electricity generation by H/E power stations is 12% in 2030 in relation to 2020, and has been calculated taking into account the average domestic hydraulicity based on historical data per geographical water resource.

Although solar power plants and geothermal plants did not contribute in 2017, in 2030, they are expected to have a small contribution of 0.5% and 1.1% respectively in the total domestic electricity generation, but with particularly significant advantages for the operation of the energy system. It should be noted that in terms of geothermal power generation, from a technical and economic point of view, there are prospects of achieving even greater contribution in the power mix, but an average scenario has been taken into account in the energy simulation as no corresponding electricity generation plant is currently in place. Additionally, their contribution as a share should be added to that of the plants using bioenergy, increasing the total share of these distributed RES plants to 4% of total domestic electricity generation and 6% of RES electricity generation.

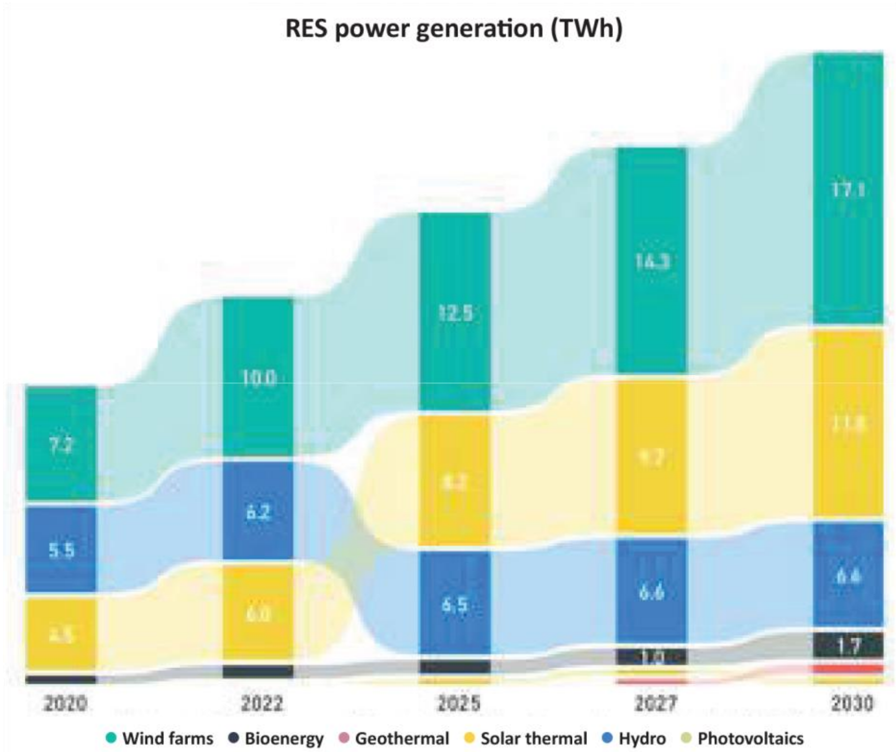


Chart 34: Evolution of electricity generation from RES until 2030.

In 2030, all fully distributed RES plants together, including hydroelectric plants, will represent a 16% share in total domestic electricity generation and a 24% share in electricity generation from RES.

Chart 35 shows the share of electricity generation from uncontrolled RES (wind and photovoltaic power plants) in total electricity supply, increasing from 17% in 2017 to 45% in 2030, which reflects the technical, operational and market challenges that should be optimally resolved for market participants, consumers and the electricity system.

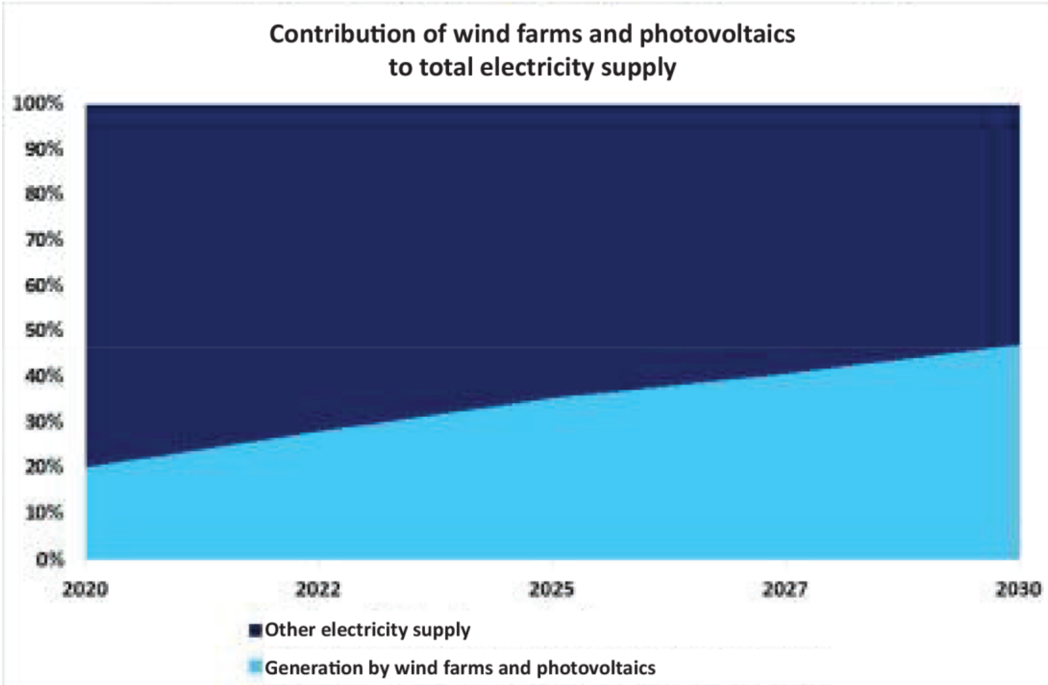


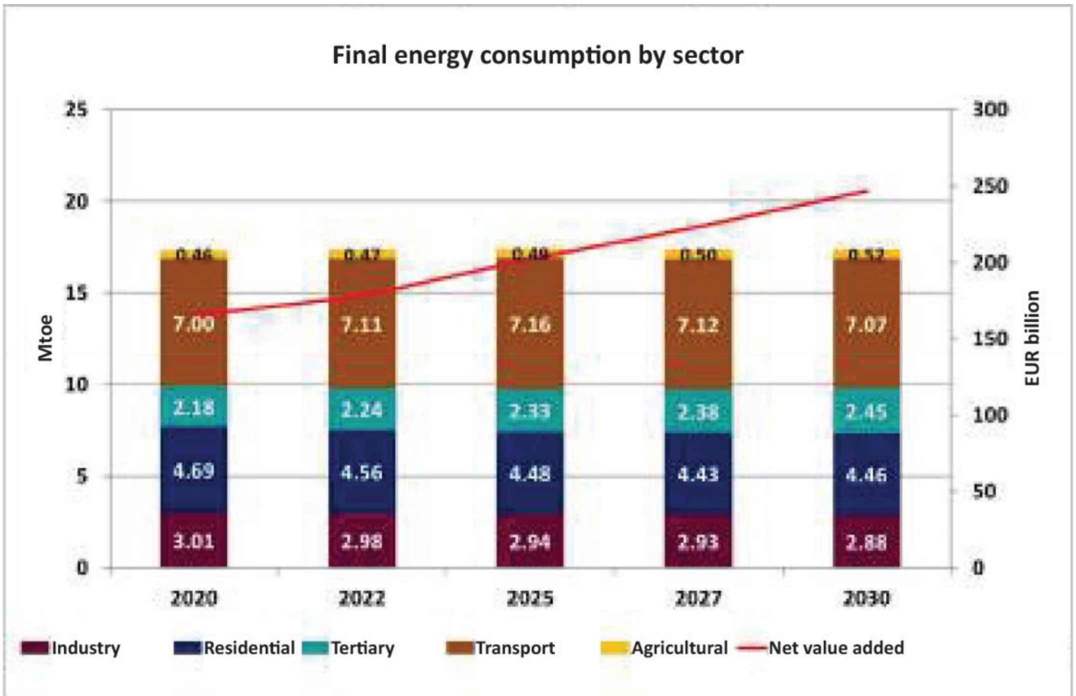
Chart 35: Time illustrations of the share of electricity generation by wind farms and solar parks in total electricity distribution.

The development of transmission networks shall include the full interconnection of the Cyclades, Crete, the Dodecanese and most of the islands of the North Aegean by 2029 (according to the schedule presented in the assumptions for interconnections), as well as strengthening the transmission system, aiming to optimise the use of the potential of RES, to make use of local geothermal and solar thermal fields, to meet the demand for energy from cleaner sources as compared to energy from petroleum plants on the islands, and to prepare the system for higher RES penetration. The objectives achievement scenario takes for granted that the necessary measures have been taken to prevent the saturation of networks, which may result from the integration of new and increasing uncontrolled RES plants.

4.3.5 Development of energy consumption in end-use sectors

The graphs below show the development of energy consumption in end-use sectors until 2030, taking into account assumptions regarding the development of demand in each end-use sector.

Examining this development, it is found that final energy consumption is stabilised at the levels of 2020 until 2030, despite the increasing trend of economic figures, the available income of households and the added value of economic sectors, which affects the development of demand to a great extent. Due to the implementation of energy saving measures and policies and due to the flexibility of demand, final energy consumption compared to 2020 is almost stabilised, with the minimum increase by 2025 falling to the initial levels in 2030.



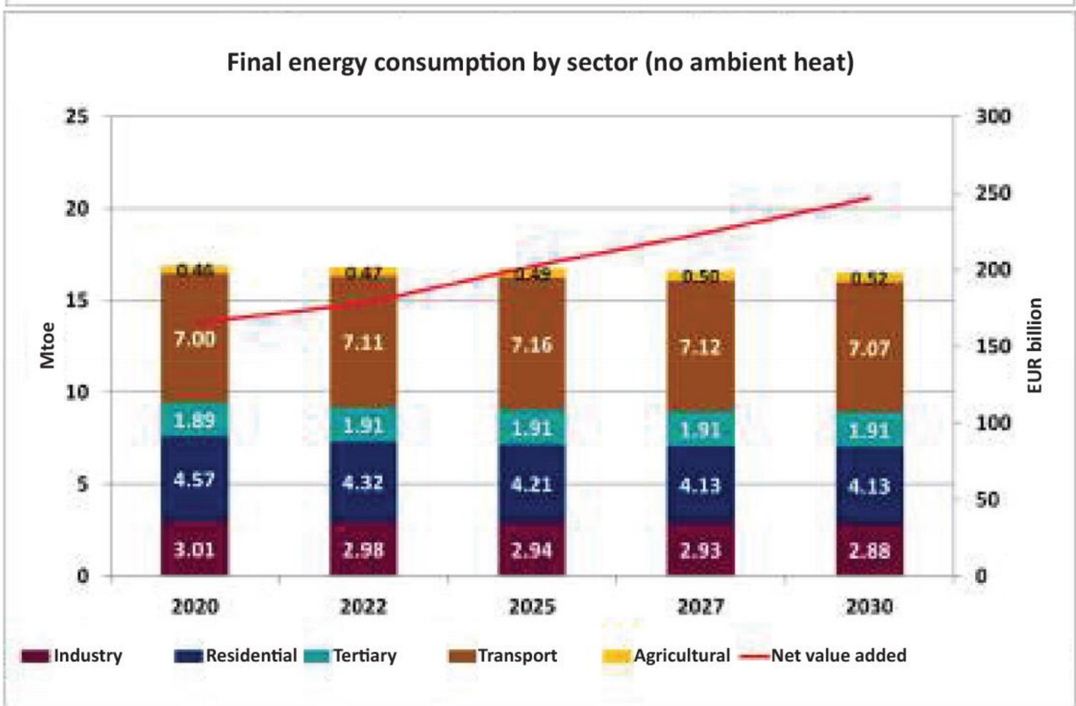


Chart 36: Evolution of final energy consumption by sector by 2030 with and without ambient heat.

The constant trend of final consumption in relation to the increasing rate of added value is shown in Chart 36. The same chart shows the downward trend in final consumption without taking into account ambient heat.

At the level of end-use sectors, the transport sector, which is historically linked to the largest portion of final energy consumption, and despite the slight increase in the sector's final energy consumption between 2020 and 2022, is maintained at 7 Mtoe in the period 2020-2030 and starts decreasing gradually after 2025. Through the gradual replacement of the non-energy-efficient fleet of vehicles, as well as the upgrading of public transport vehicles, the above-mentioned energy consumption appears reduced by 0.39 Mtoe as compared to the average consumption of the decade 2006-2017 and by approximately 2.1 Mtoe as compared to the historical high of 2009. It is worth noting that maintaining final energy consumption at the same levels has also absorbed the increase in consumption in the sub-sectors of air transport and maritime shipping, which is related to the increase of transport in the respective sub-sectors (Chart 37). In particular, final consumption in the transport sector excluding air transport and shipping at the end of the decade (2030) is reduced by 4% compared to consumption at the beginning of the decade (2020).

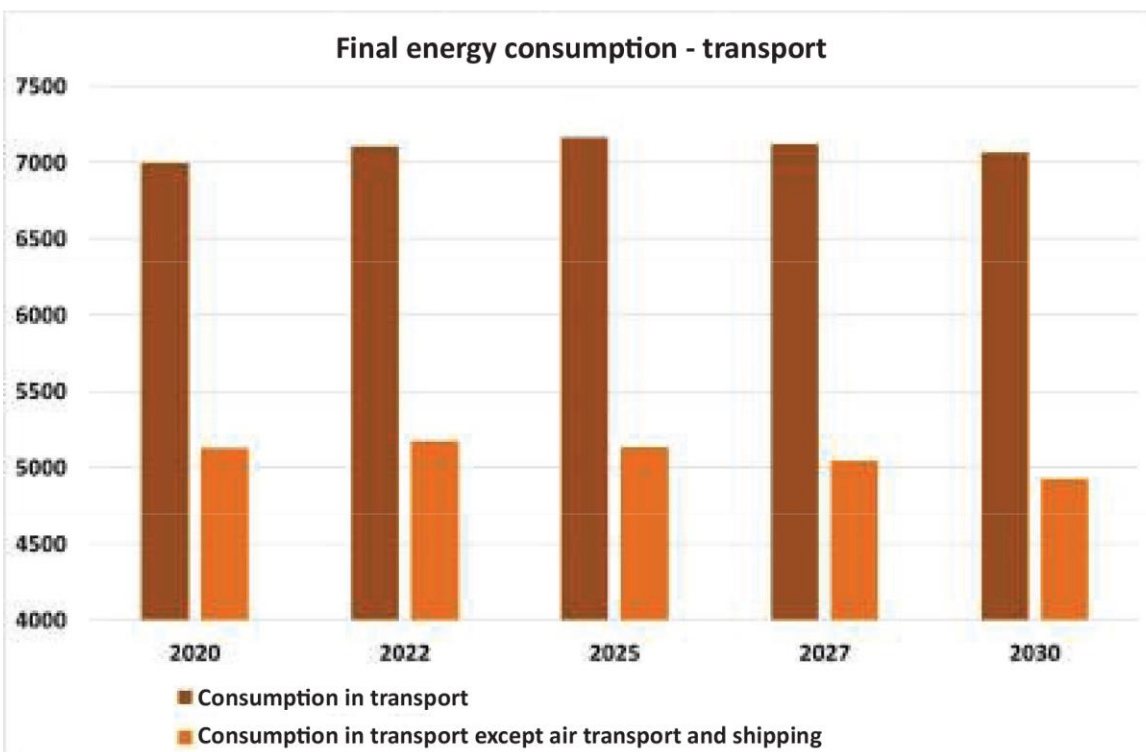


Chart 37: Development of final energy consumption by sector until 2030, with the exception of energy consumption in the sub-sectors of air transport and maritime shipping.

The contribution of the household sector in total final consumption in 2020 shall be 27%, but it is reduced to 25.7% in 2030. This demonstrates that in addition to the containment observed in all final energy consumption, measures to improve energy efficiency and achieve energy savings also reduce energy consumption in this sector. In absolute figures, the average consumption in the period 2020-2030 shows a decrease compared to the corresponding consumption in the period 2006-2017 from 4.7 Mtoe to 4.5 Mtoe, and the difference is even stronger in comparison to the historically maximum consumption of 5.5 Mtoe in 2006.

Chart 38 shows the overall estimate for reduced energy consumption compared to the estimate made in 2007 for 2030, and its breakdown into the key end-use sectors by 2030. Specifically, final energy consumption for the year 2030 is estimated to be lower by 10.3 Mtoe than the corresponding forecasts made in 2007 for the year 2030. The residential and transport sectors are identified as key areas for improving energy efficiency compared to the forecasts made in 2007.

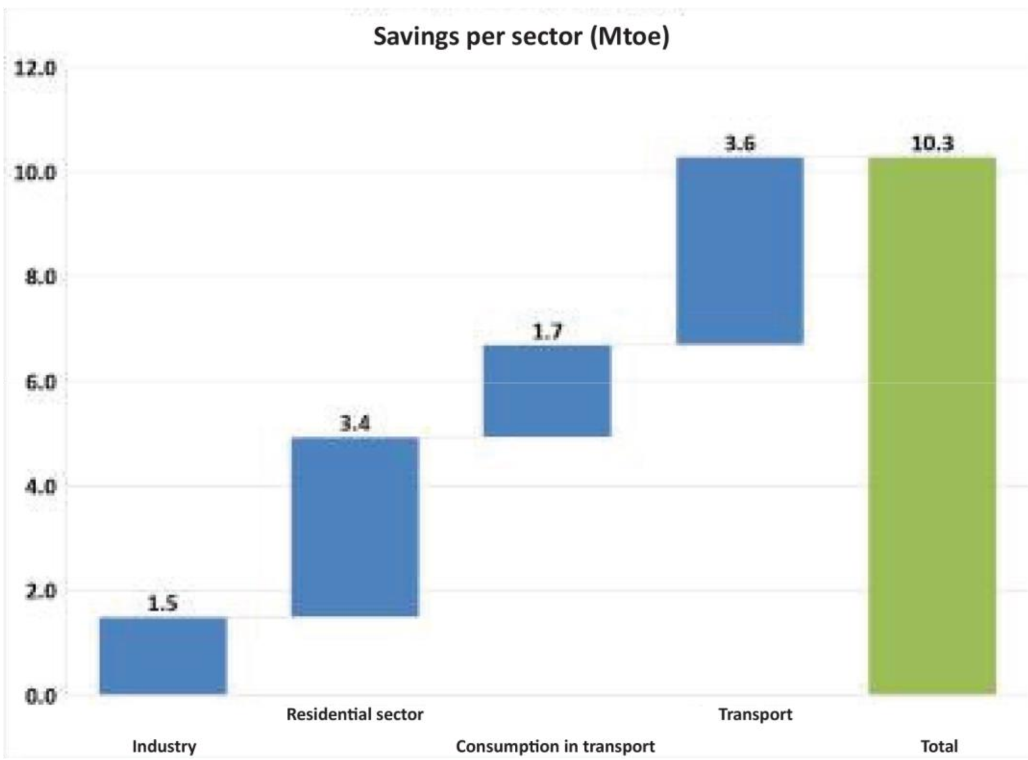


Chart 38: Energy saving by sector by 2030 compared to final consumption forecast by sector in 2007.

Particularly in the residential sector, it is estimated that there will be a comparable reduction in energy consumption by about 3.4 Mtoe compared to 2007 forecasts, while in the transport sector the forecast for consumption decrease by 3.6 Mtoe is respectively estimated to be mainly due to the improvement of the efficiency of vehicles, as well as to the upgrading of public transport. An important contribution to this comparative reduction in consumption estimation is also made by the industry sector, where the reduction amounts to 1.5 Mtoe between the 2 forecasts for 2030, with significant potential for energy savings. Finally, the tertiary sector along with the agricultural sector are experiencing a comparable decline of 1.7 Mtoe for the year 2030, with the majority due to upgrades to lighting, street lighting and heat pump installation, as well as to the improved efficiency of end-use appliances in the tertiary sector.

Moreover, perhaps even more representative is the comparison with the 2005 primary and final energy consumption figures and the drawing of some useful conclusions about improving energy efficiency (Chart 39).

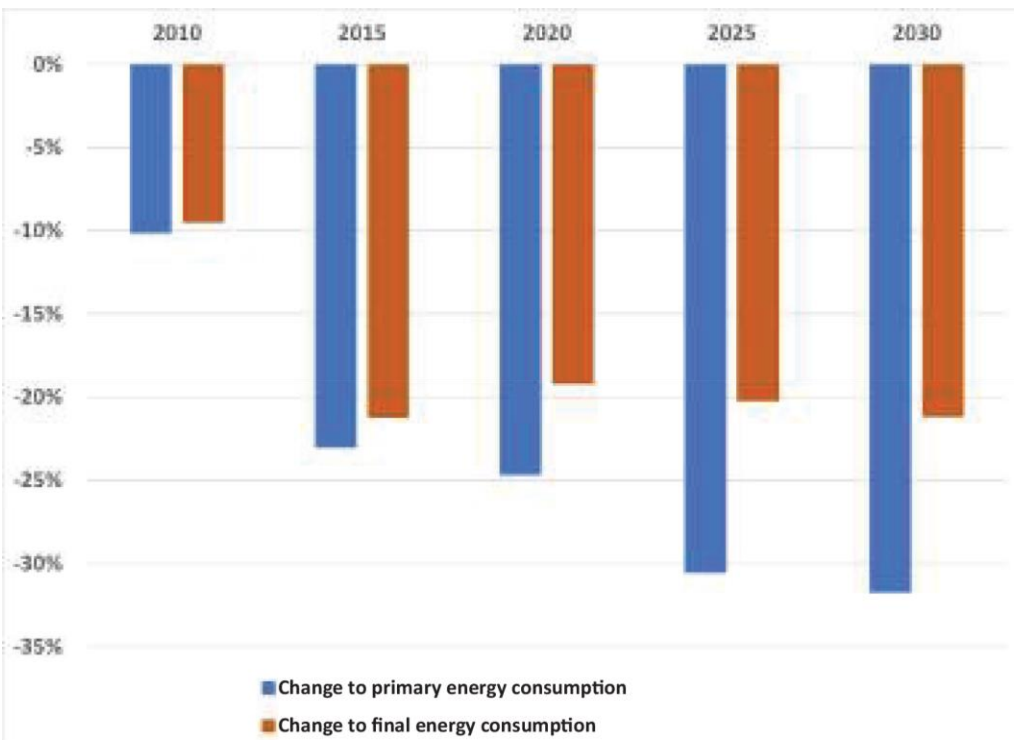


Chart 39: Energy efficiency improvement indicator compared to 2005.

In particular, on the basis of the energy simulation that also provides for the lowest absolute values of both primary and final energy consumption, the improvement in energy efficiency achieved is particularly high. Specifically, the results of these indicators show that while there is relative stabilisation in 2020, as a result of the higher consumption to meet energy needs after the economic downturn, there is a forecast for significant improvement, resulting in high energy efficiency improvement indicators compared to the actual ex post figures for 2005.

It should be noted that the simulation with the PRIMES energy model results in an even greater reduction for both primary and final energy consumption in 2030 compared to 2005.

4.3.6 Development of energy consumption in the residential sector

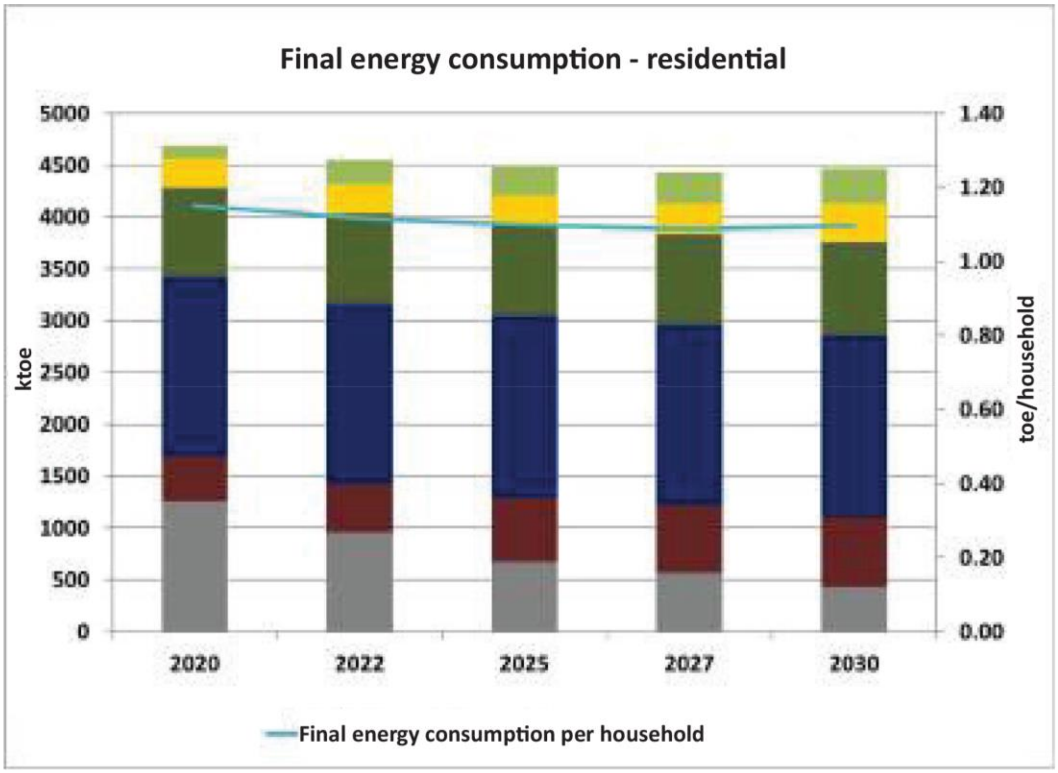
The residential sector shows a decline in energy consumption of 0.2 Mtoe in the year 2030 compared to the year 2020 in the residential sector (Table 39 and Chart 40). The largest share of final consumption is now held by electricity, bioenergy and natural gas, with a total share of the residential sector's final consumption of 73% in 2030. The highest increase is observed in the use of natural gas, with its market share in total consumption increasing from 9.5% in 2020 to 16% in 2030, replacing part of oil consumption for heating, the share of which is significantly reduced from 28% in 2020 to 11% in 2030.

Table 39: Final energy consumption in the household sector until 2030, based on the objectives achievement scenario.

Residential sector	2020	2022	2025	2027	2030
Final energy consumption	**4690**	**4555**	**4480**	**4430**	**4465**
Consumption by fuel					
Petroleum products	*1260*	*958*	*676*	*571*	*433*
Natural Gas	*432*	*470*	*618*	*654*	*673*
Electricity	*1719*	*1726*	*1744*	*1729*	*1748*
District heating	*43*	*43*	*41*	*40*	*39*
Bioenergy	*830*	*835*	*843*	*841*	*860*
Solar	*281*	*284*	*288*	*298*	*377*
RES for heat pumps (ambient heat and low enthalpy geothermal energy)	*126*	*239*	*270*	*297*	*336*
CO_2 emissions from the Household sector [Mt CO_2]	**4.9**	**4.0**	**3.5**	**3.3**	**2.9**
Final energy consumption per household [toe/household]	**1.15**	**1.12**	**1.10**	**1.09**	**1.09**

Moreover, the use of solar thermal systems increased by 34% in 2030 compared to 2020, while an increase of 2% in 2030 compared to 2020 is also observed in electricity consumption, which is mainly due to the increase in electricity rather than to the measures aimed at improving energy efficiency. Heat pumps (as ambient heat excluding electricity consumption) and geothermal energy are projected to account for 8% of the final energy consumption of the residential sector in 2030 compared to 3% in 2020. Respectively, the forecast for the use of bioenergy increases marginally both in absolute terms and in percentages and is estimated from 18% in 2020 to 21% of final energy consumption of the residential sector in 2030. In addition, while overall it is estimated that there will be a marginal increase in the use of bioenergy, that is primarily solid biomass, it is estimated that its use will be reduced in urban areas at regional level, with a significant decrease in absolute figures (over 5%) from the historic highs observed in 2012.

According to the available historical data, it is noted that the final energy consumption in the household sector is strongly linked to heating degree days. This correlation seems to have ceased to exist from the year 2012 onwards, mainly due to the economic crisis. That is to say, it is observed that, in the first years of the economic crisis, maintaining heating comfort was a priority for Greek households; however, the lasting crisis period made it gradually impossible for them to continue covering their needs sufficiently. Therefore, during the period of exiting the economic crisis and until 2030, an increase in final energy consumption in the household sector should be expected, reaching the levels of the previous decade in order to meet previously unmet energy demand. However, the stabilisation of the final consumption estimated for the period 2020-2030 is mainly due to the inclusion of targeted energy efficiency improvement measures and ultimately energy savings that will be achieved during this period, while also taking into account the improved energy efficiency of the new energy devices. This conclusion is reinforced by the fact that the average final energy consumption of the residential sector in the period 2020-2030 appears reduced by 14% compared to the corresponding average consumption in the period 2002-2012.



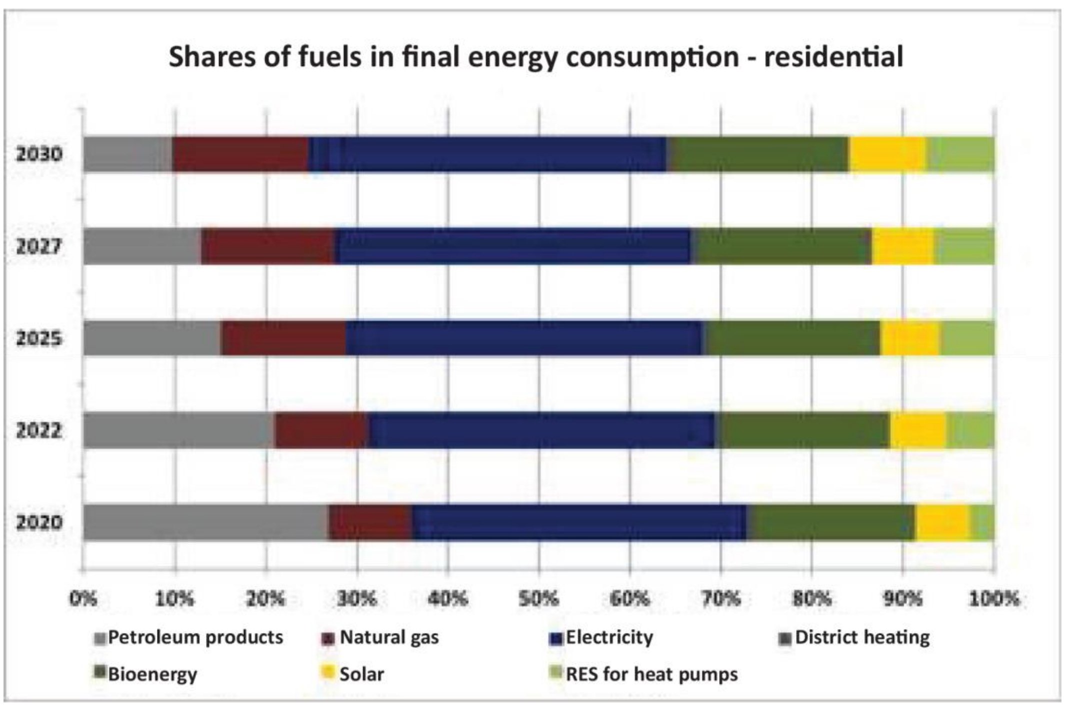


Chart 40: Development of final energy consumption in the household sector until 2030.

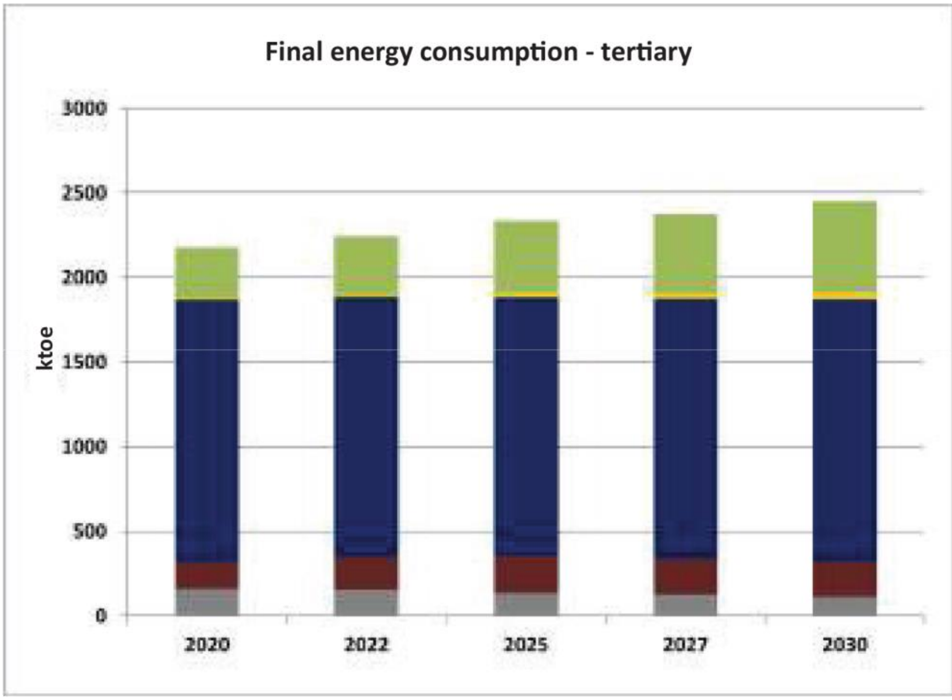
4.3.7 Development of energy consumption in the tertiary sector

In the tertiary sector it is estimated that there will be an increase in the total energy consumption of around 12% over the next decade, but if the contribution of ambient heat is deducted, then it is estimated that energy consumption will be stabilised (Table 40 and Chart 41). The technology sector is dominated by the penetration of heat pumps with a participation rate of 22% in 2030 compared to 13% in 2020 (ambient heat and electricity consumption are also taken into account for the calculation of the share). Heat pumps are able to meet both heating and cooling needs; therefore, they are introduced mainly to replace old boiler/cooler systems as well as old, low-performing air conditioners.

Table 40: Final energy consumption in the tertiary sector until 2030, based on the objectives achievement scenario.

Tertiary sector	2020	2022	2025	2027	2030
Final energy consumption	**2177**	**2239**	**2331**	**2376**	**2451**
Consumption by fuel					
Petroleum products	159	154	137	126	112
Natural Gas	163	200	218	216	214
Electricity	1541	1526	1521	1528	1539
District heating	0	0	0	0	0
Bioenergy	9	9	8	8	11
Solar	15	19	24	28	34
RES for heat pumps	290	333	423	469	541
CO_2 emissions from the Tertiary sector [Mt CO_2]	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**
Energy Productivity in the Tertiary Sector [million € '10/ktoe]	**62.19**	**64.02**	**65.91**	**67.11**	**68.92**

The penetration of heat pumps, where part of their consumption relates to electricity and the rest to ambient energy (RES), the progressive replacement of old lighting systems to new, high energy efficiency ones, including the energy upgrade of street lighting, but also the use of more energy-efficient devices, lead to a stable share of electricity, by 81-82%, and a constant consumption in absolute energy figures. Finally, the increase in the consumption of natural gas by 31% in the period 2020-2030, also contributes to the reduction of the final consumption of energy from oil by 30% in the same period. As a result, oil represents only 8% of total consumption, compared to an average of 15% over the period 2000-2013.



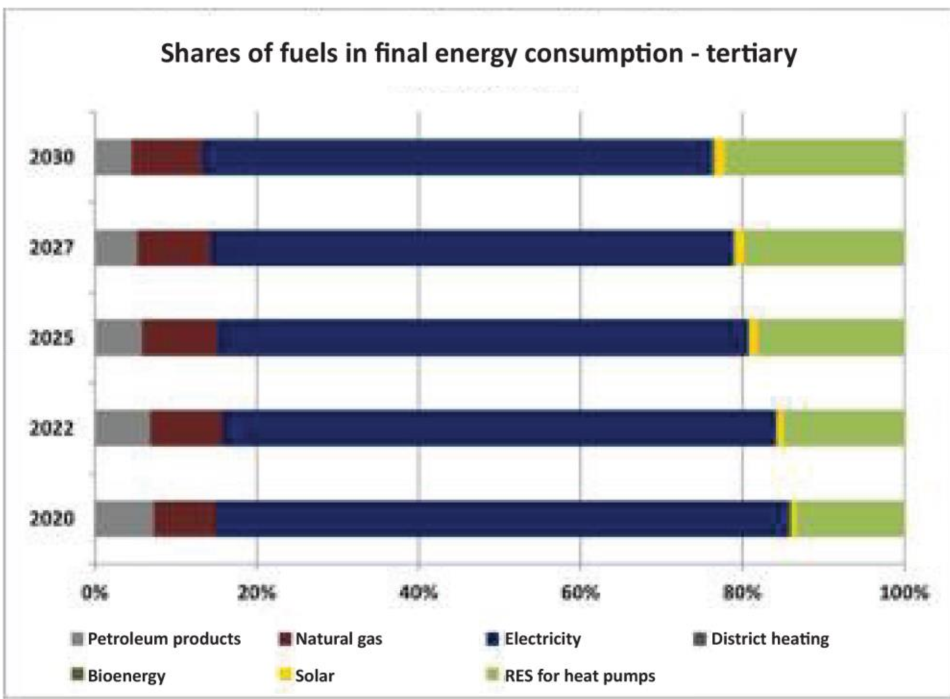


Chart 41: Development of final energy consumption in the tertiary sector until 2030.

Targeted energy efficiency improvement measures are expected to contribute to increasing the building stock renovation rates, placing the country's overall building stock renovation rate above the European annual 1% average. In particular, in the housing sector, it is expected that by 2030 12-15% of the total number of dwellings in the country, i.e. up to 60 000 homes per year, will be upgraded in terms of energy efficiency (in part or in full). Such energy upgrades also include the dwellings of vulnerable households through targeted actions, thus addressing energy poverty and aiming to achieve the relevant national objective set. As regards public buildings, it is expected that at least the target for upgrading and renovating in terms of energy efficiency 3% of the total surface area of the buildings used by the central government every year until 2030, will be met.

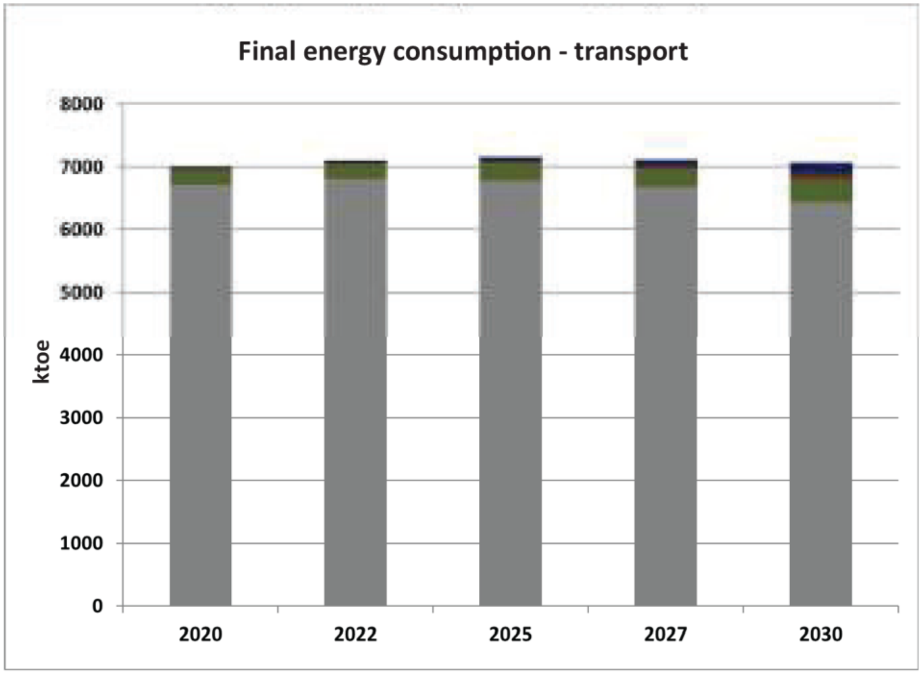
4.3.8 Development of energy consumption in the transport sector

In the transport sector, a relatively large market penetration of biofuels and electricity is observed, as well as a corresponding decrease in petroleum products (Table 41 and Chart 42). However, the decrease in the use of petroleum products in the transport sector is low both in absolute figures and in percentages compared to that of 2020, as it appears around 4% in 2030, its share decreasing to 91% in 2030 compared to 96% in 2020. The use of biofuels increases significantly, as their share also doubles and their percentage in total consumption increases to 5% in 2030, as opposed to 3% in 2020. Electricity has a 2% share in total energy consumption in 2030, i.e. 154 ktoe in 2030 as opposed to 18 ktoe in 2020, in absolute figures.

Table 41: Final energy consumption in the transport sector until 2030, based on the objectives achievement scenario.

Transport sector	2020	2022	2025	2027	2030
Final energy consumption	**6997**	**7108**	**7163**	**7121**	**7066**
Consumption by fuel					
Petroleum products	6723	6810	6780	6691	6439
Bioenergy	228	238	283	287	371
Natural Gas	28	32	42	57	102
Electricity	18	28	58	86	154
CO_2 emissions from the Transport sector [Mt CO_2]	18.1	18.3	18.1	17.9	17.2
Advanced biofuels (in accordance with Part A of Annex IX to Directive (EU) 2018/2001)	**2020**	**2022**	**2025**	**2027**	**2030**
Consumption (ktoe)	81	94	127	127	197

Please note that the development of the participation of biofuels in the energy mix of the transport sector to represent such a high share shall be subject to the participation of advanced biofuels and the enhancement of their mixing rates into diesel and petrol. In particular, advanced biofuels are estimated to contribute by almost 53% to the total energy content of biofuels by 2030. This high participation share implies the importance of taking and implementing specific measures that will make this participation, which aims mainly at domestic production, more cost-effective.



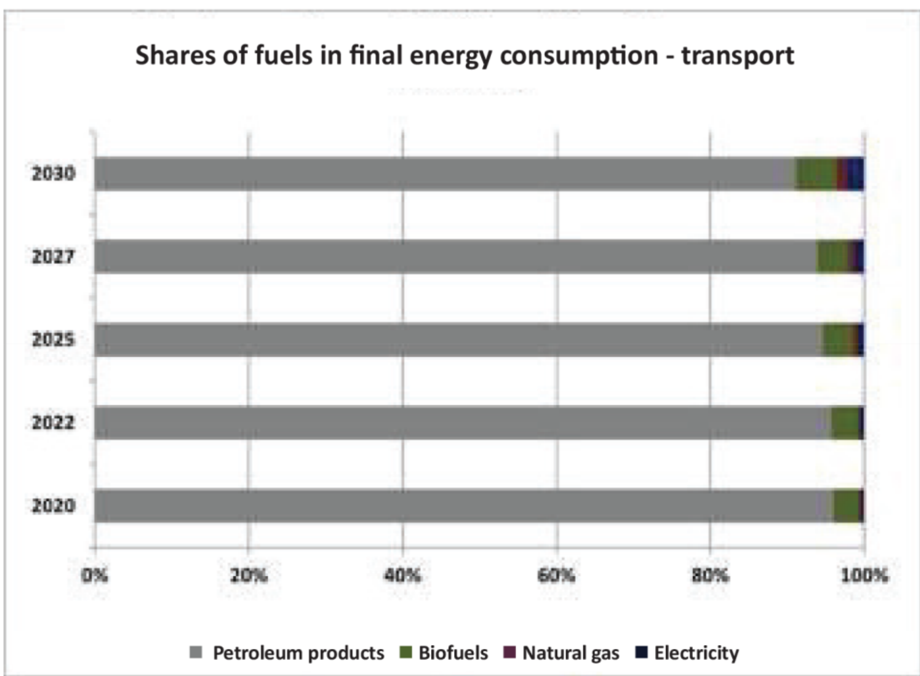


Chart 42: Development of final energy consumption in the transport sector until 2030.

It is a challenge to develop appropriate infrastructure, supply chains and production plants in order to strengthen the domestic production of such fuels, thereby contributing to the increase of domestic added value and to the decrease of the country's energy dependency.

However, if air transport and domestic maritime shipping consumption is exempted from the transport sector, the share of petroleum products appears more significant, as it decreases from 95% in 2020 to 88% in 2030. This is due to the significant penetration of electrification and biofuels in these sub-sectors of the transport sector, their aggregate share increasing to 10% in 2030 (Chart 43). Particularly with regard to electrification in road transport, the results of energy simulations show an exponential increase in their participation share in the passenger car fleet after 2027, and there will also be an increase in their share in new registrations. By 2027, the share of the total passenger fleet is not projected to exceed 4% and different penetration scenarios have been taken into account over the last three years on the basis of the energy models and economic assumptions adopted for the evolution of the acquisition and operating costs of these vehicles.

As has been pointed out in Chapters 2 and 3, the aim is to increase the share of electric passenger cars in new registrations to 30% by the year 2030 and, based in this share, to plan the corresponding measures and to monitor them.

Scenarios of energy simulations show that if this high share of new registrations is reached already by 2027 and kept steady and relatively steady until 2030, then a high 9% share of the total fleet can be achieved, reflecting the final trend that will emerge in the beginning of the next decade for the gradual electrification of road passenger transport. However, the current domestic market data and analysis shows that this cannot be achieved and that such a share substantially relies on the radical changes in vehicle types over the last period and has a high degree of uncertainty.

The convergence of the individual shares between the energy simulations and the analysis of domestic market developments will in any case be included in the monitored of the implementation of the NECP, in order to make appropriate adjustments to the forecasts of vehicle shares in road transport in the year 2030.

The gradual renewal of the existing fleet of passenger vehicles, with new, more energy-efficient transport units, such as electric vehicles and more efficient internal combustion vehicles, will lead to a decline in the final energy consumption of passenger vehicles, amounting to 11%, 401 ktoe in absolute figures for the period 2020-2030. For example, the electrification of road passenger transport leads to a significant improvement in energy efficiency per transport unit, unit consumption decreasing to 24.6 ktoe/kpkm in 2030 compared to 31.8 ktoe/kpkm in 2020. Furthermore, the full electrification of track-based modes will lead to a decline in final energy consumption in the sub-sector in passenger transport by 22%. In particular, electrification of the transport sector will mainly be achieved by rail, where for road and rail transport in the year 2030, the share of electricity is expected to reach 4% from 0.4% in 2020 (Chart 43). Concerning transport work, although the share of fixed track modes in total passenger transport remains low, the share is increasing from 2020 to 2030, and account should also be given to the fact that, due to the lack of valid data, the results of the energy simulation do not adequately reflect the potential of policy measures aimed at reducing private use vehicles and its replacement by the use of public transportation, which however has high potential for improving energy efficiency in the transport sector.

Chart 44 and 45 also show the trend of energy consumption in road passenger transport per vehicle category according to energy simulations from both energy models, where similar trends in consumption reduction and participation shares of different vehicle categories are estimated. The replacement of petroleum fuels in various modes of transport, is integrated in the general framework of policies in the transport sector, where, in conjunction with urban mobility actions and the enhancement of the role of urban track-based modes and railways, which are expected to undertake some of the transport load of passenger and commercial vehicles, will achieve the maximum possible energy savings and the improvement of energy efficiency per transport unit. In addition, a further penetration of natural gas is foreseen, mostly through new registrations in the transport sector, especially in the category of buses and heavy vehicles, thus primarily achieving environmental benefits compared to the previous situation.

Accordingly, biofuels are expected to replace a large share of oil consumption over the period 2020-2030, thus transforming their participation share in the passenger vehicles sub-sector from 3% to 7%.

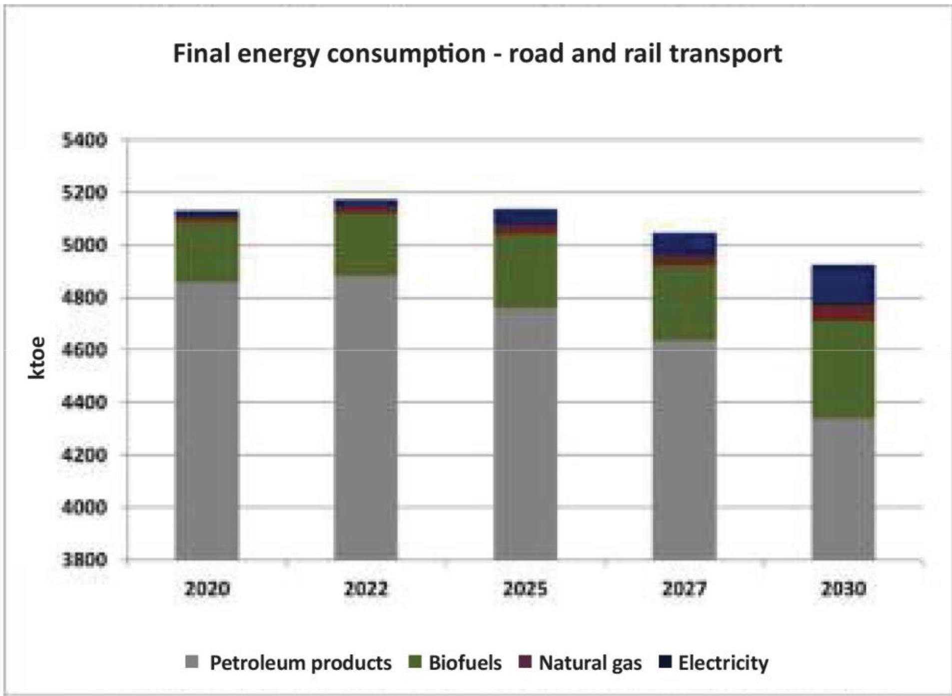


Chart 43: Development of final energy consumption in road and rail transport until 2030.

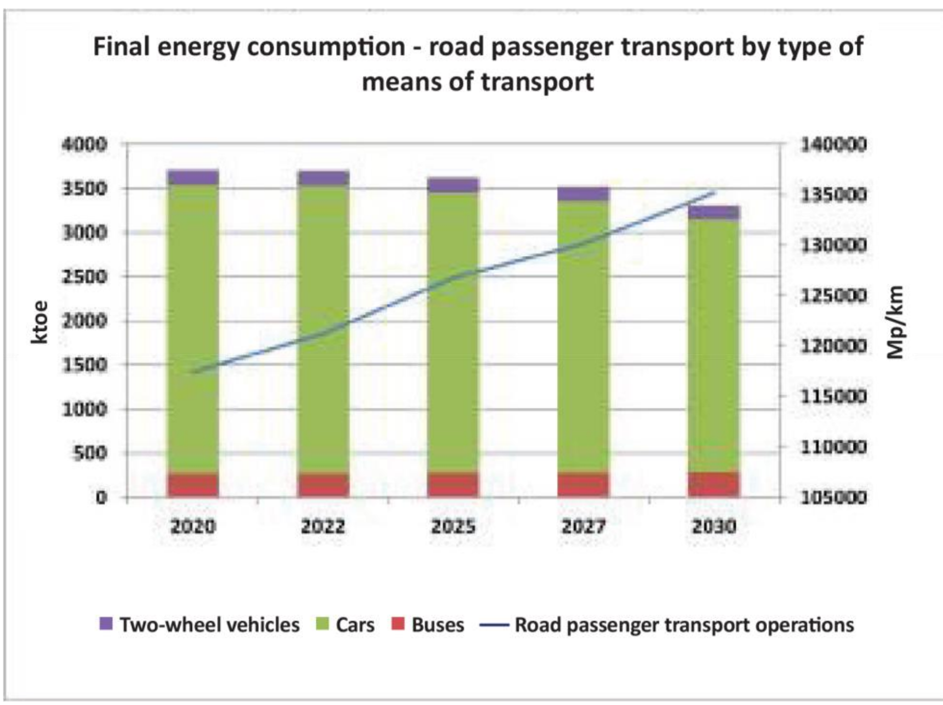


Chart 44: Development of final energy consumption for road passenger transport by type of means of transport until 2030 (according to the TIMES energy model).

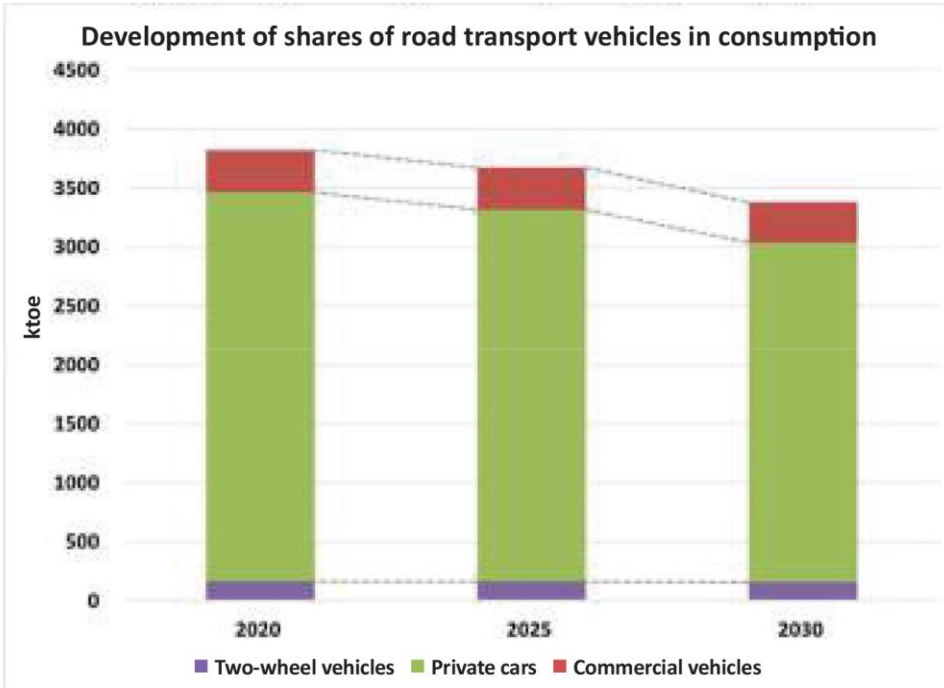


Chart 45: Development of final energy consumption for road passenger transport by type of means of transport until 2030 (according to the PRIMES energy model).

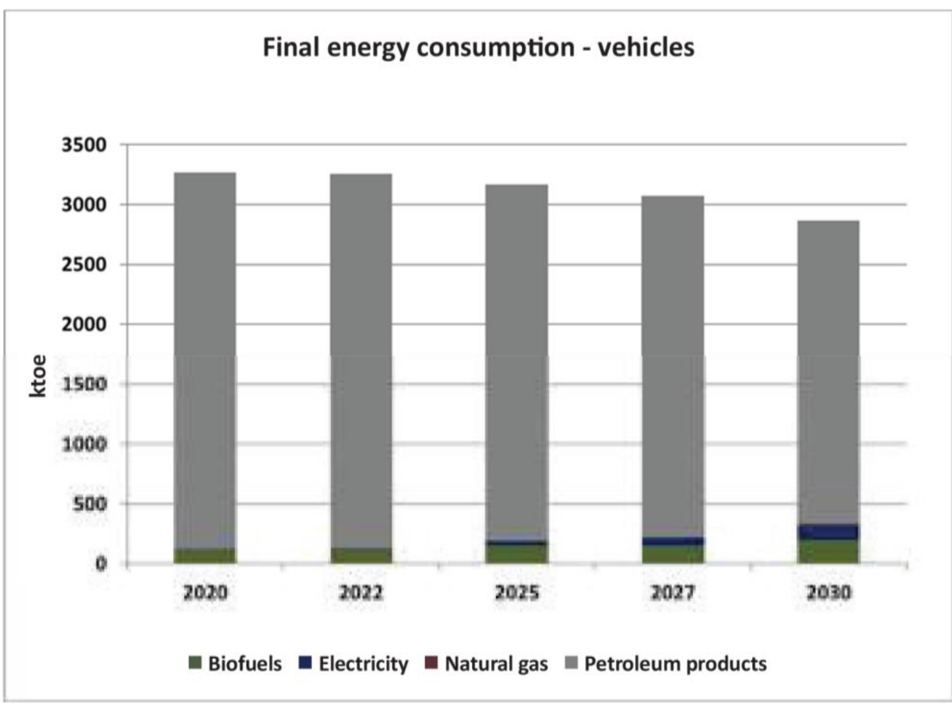


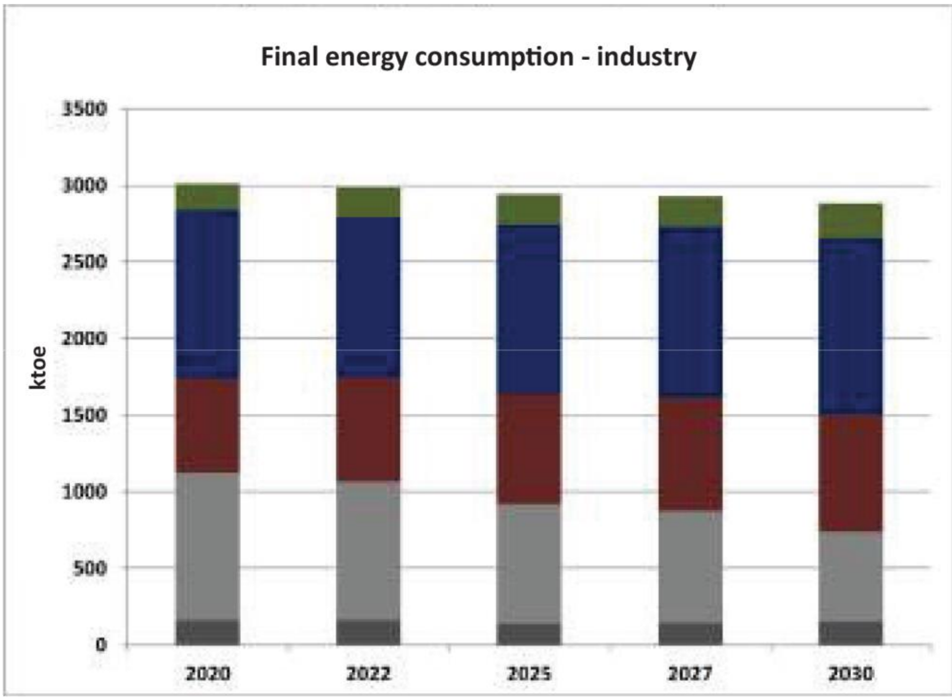
Chart 46: Development of final energy consumption of cars by type of fuel until 2030.

4.3.9 Development of energy consumption in industry

In industry, during the period 2020-2030, there is a slight decrease in final energy consumption, mainly due to the implementation of energy audit recommendations and other energy efficiency improvement measures in the sector (Table 42 and Chart 47). In particular, there is an overall decrease in energy consumption by 4% in 2030 compared to that in 2020. This decrease leads to a 29% improvement in energy productivity in the sector in 2030 compared to 2020.

Table 42: Final energy consumption in the industrial sector until 2030, based on the objectives achievement scenario.

Industry	2020	2022	2025	2027	2030
Final energy consumption	**3011**	**2984**	**2943**	**2928**	**2879**
Consumption by fuel					
Solid fuels	159	162	139	141	153
Petroleum products	964	904	782	735	588
Natural Gas	620	684	718	745	770
Electricity	1093	1045	1102	1108	1140
Bioenergy	174	189	203	199	227
CO_2 emissions from Industry [Mt CO_2]	9.9	9.9	9.4	9.3	8.8
Energy Productivity in Industry [million EUR '10/ktoe]	7.37	7.76	8.43	8.86	9.51



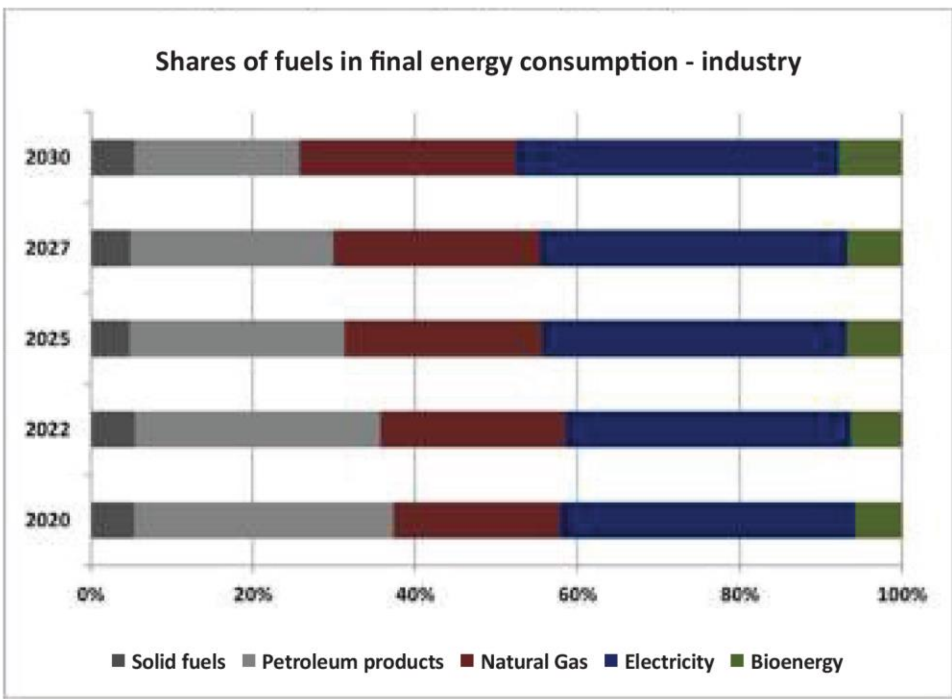


Chart 47: Development of final energy consumption in the industry sector until 2030.

As regards the shares of individual energy products, a 24% increase is observed in the final consumption of natural gas in 2030 compared to that in 2020, followed by a 31% increase in the consumption of bioenergy over the same period. On the contrary, the consumption of petroleum products in the period 2016-2030 is reduced by 39%, while their share in total final energy consumption is also reduced from 32% in 2020 to 20% in 2030. As the consumption of petroleum products drops, they are replaced by natural gas and electricity. In particular, in 2030, the share of natural gas and electricity in final energy consumption amounts to 27% and 40% respectively, compared to 21% and 36% respectively in the year 2020.

4.4 Comparative presentation of revised NECP results based on different energy simulations

This section presents the results of the National Reform Programme scenario, on the evolution of key energy system figures, in relation to the two energy models used (TIMES and PRIMES) when developing the NECP.

The presentation of the results from the two different energy models focuses essentially on comparing the figures for the two crucial years 2021-2030, 2025 and 2030, where the differentiation between the two energy simulations is presented, providing a broader framework for the evaluation of possible roadmaps towards achieving energy and climate goals for the year 2030. This diversification allows for monitoring the achievement of energy and climate objectives on the basis of different scenarios and therefore different weighting on the adoption of specific policy measures depending on the evolution of the energy system in specific time markers over the next period.

The following graphs show the results of the two energy simulations for the following figures:

I. the shaping of the domestic mix of energy and power generation,
II. the levels of GHG emission reduction,
III. the evolution of RES participation in key sectors and as a whole, and
IV. the evolution of final energy consumption and its breakdown by fuel and by end-use sector.

The results from the two energy models essentially show a convergence in terms of all the key components that contribute to the achievement of the national energy and climate objectives for 2030 and contribute to a transparent and methodologically complete focus, emphasis, adoption and ultimately time scheduling of specific policy measures to support the implementation of the selected policy priorities to achieve the NECP objectives for 2030.

Initially, with respect to the projected total greenhouse gas emissions (Chart 48), there is an interesting difference in the results of the two energy simulations for the targets achievement scenario, which is more evident in the year 2030. Specifically, although the results of both energy models present a very high reduction in CO2 emissions compared to 2005, this reduction appears to be higher under the PRIMES energy model, leading to the conclusion that a relatively different mix of measures and technologies has been selected between the two energy models with differences in fuel distribution and use.

Specifically, the GHG emission reduction rates compared to 2005 are -50% for both TIMES and PRIMES models, respectively, for the year 2025, while the decrease is -56% and -59% for the TIMES and PRIMES, respectively, for the year 2030.

The differentiation observed in these results is directly related to the shares of conventional energy forms provided by the two energy models, the expected share of RES in energy consumption, and the energy intensity estimates as presented and analysed below. This divergence in the range of GHG emission reduction that is likely to be achieved during the next decade's energy transition suggests that the achievement of specific energy targets primarily guides the achievement of the climate goals set and that eventually the composition of the energy mix that will result in achieving them may lead to further GHG emission reductions. This in itself is a particularly positive finding as it demonstrates the direct correlation between the measures and the degree of their implementation between the energy and climate objectives, while confirming the correct adoption of the ambitious overall objectives of the final NECP plan.

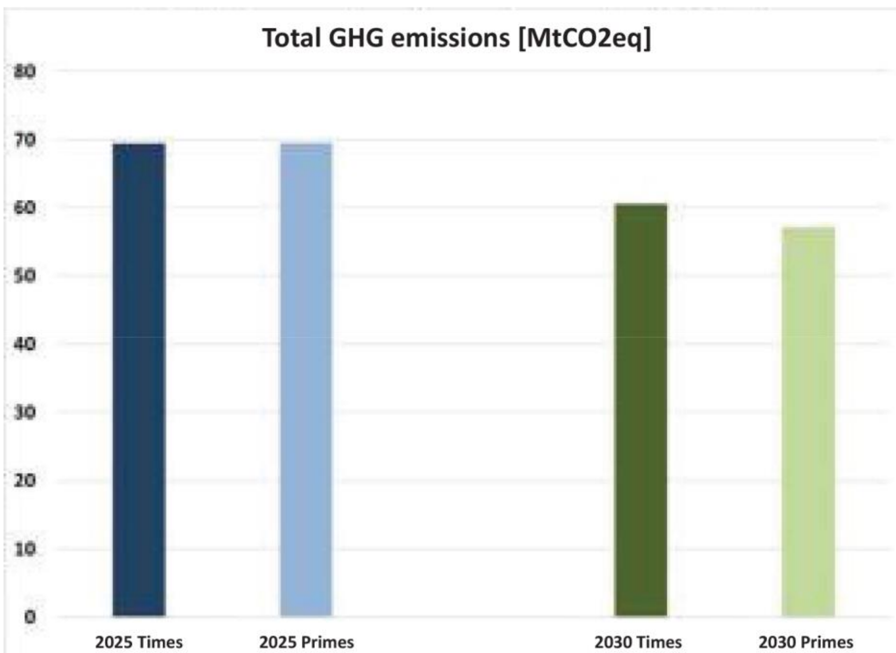


Chart 48: Total greenhouse gas emissions between different energy simulations (TIMES – PRIMES).

By analogy, the evolution of energy productivity follows the pattern of carbon emissions intensity between the two models. As shown in Chart 49, both models of energy productivity are expected to continue to improve significantly and at a steady pace until the year 2030. The difference in energy productivity levels is attributed mainly to the different levels of gross energy consumption as well as to the relatively different degree of electrification of final energy consumption.

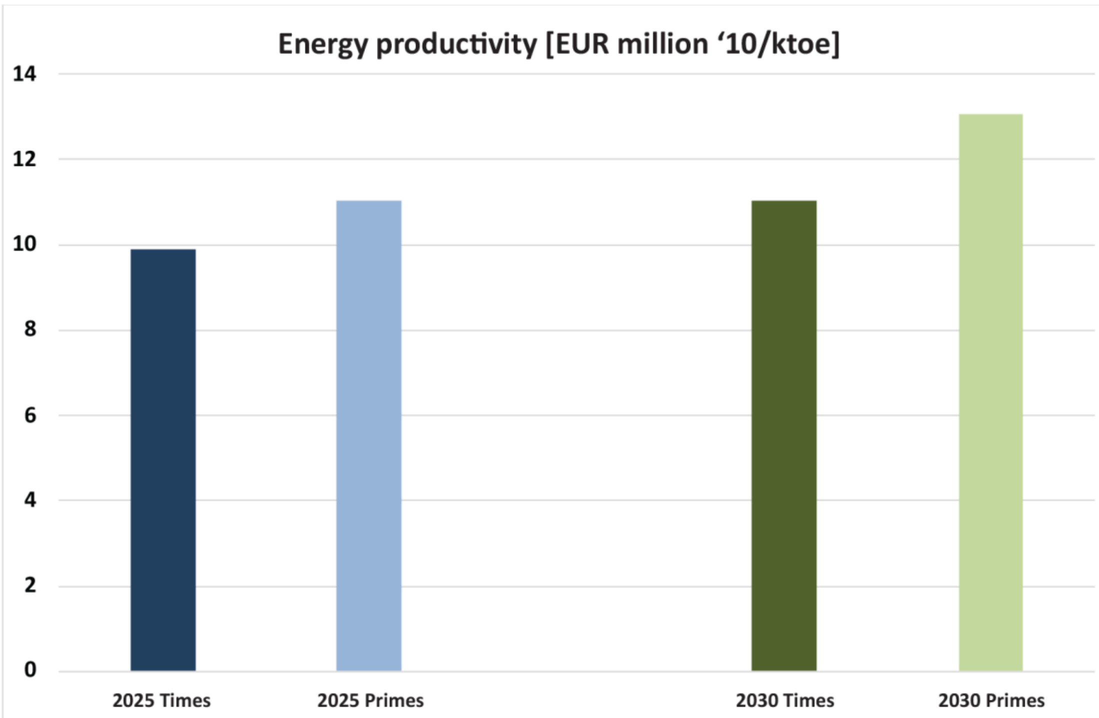


Chart 49: Energy productivity between different energy simulations (TIMES – PRIMES).

At gross domestic consumption level, the two simulations present marked differences in consumption compared to conventional fuels with TIMES results being relatively higher (Chart 50), particularly in the year 2030. Differences are also observed in the share of conventional fuels in gross domestic consumption between the two models. Specifically, gross domestic product consumption of petroleum products is estimated to decline significantly between 2025 and 2030, but this substitution is almost twice as high as the PRIMES energy model, as it exceeds 23%, while according to the TIMES energy model, it is close to 10%. However, regarding the use of petroleum products, the divergence is significant and in absolute figures of gross domestic consumption, it ranges between 21% and 33% for the two audited years (2025, 2030) and, to some extent, it is explained by the faster oil product substitution estimated from the PRIMES energy model using natural gas, electricity and RES compared to the

TIMES energy model. For natural gas, in particular, the gross domestic consumption according to the result of the TIMES energy model is estimated to remain at a constant level during the period 2025-2030. The energy simulation result from the PRIMES energy model differs in the estimation of the evolution of natural gas consumption and foresees a relatively higher gas consumption by 17% for the year 2025, which then decreases in 2030 and approximates the corresponding estimates from the TIMES energy model, but is still higher by 6%.

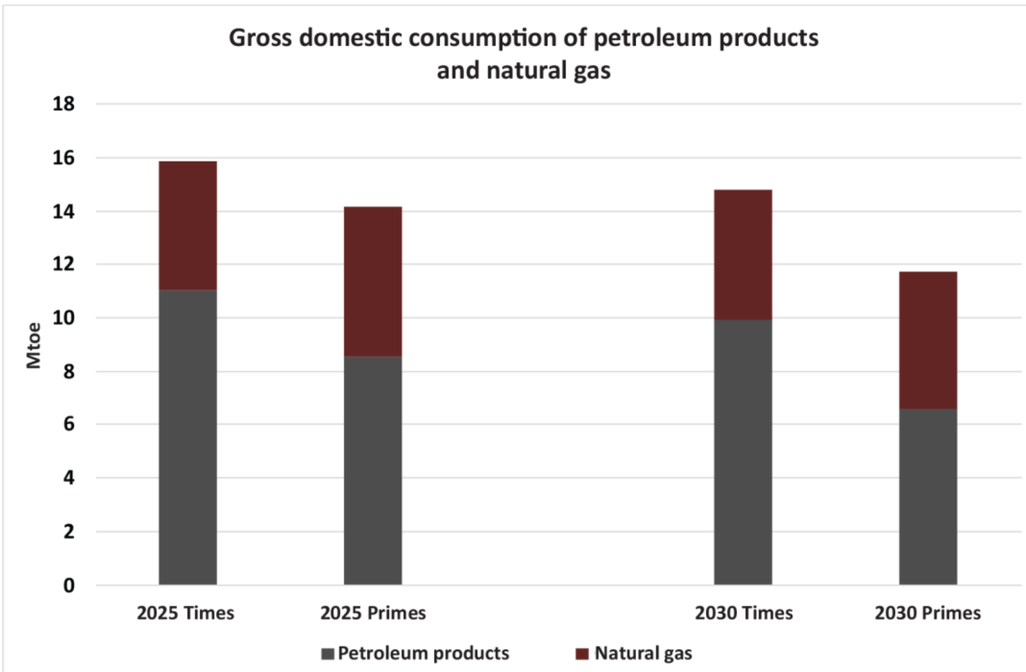


Chart 50: Gross domestic consumption of petroleum products and natural gas between different energy simulations (TIMES – PRIMES).

Of particular interest is the comparison of the estimate of the evolution of gross final electricity consumption by 2030 from the energy simulations of the two energy models. This comparison also shows a different estimate as to the degree of electrification of the energy mix and the consumption of electricity in general (Chart 51). The results from both energy simulations show the central role of RES in power generation as early as 2025, and when reduced to pure domestic electricity generation, the results from both energy models lead to shares of more than 50%. Interest in comparing results focuses primarily on total gross final electricity consumption, where there is a consistently higher consumption estimate of 5% in the results from the PRIMES model. At the electricity generation distribution level, the results from the two energy models are converging on the contribution of RES and imports in the year 2025, and on the contribution from conventional fuels and imports in the year 2030.

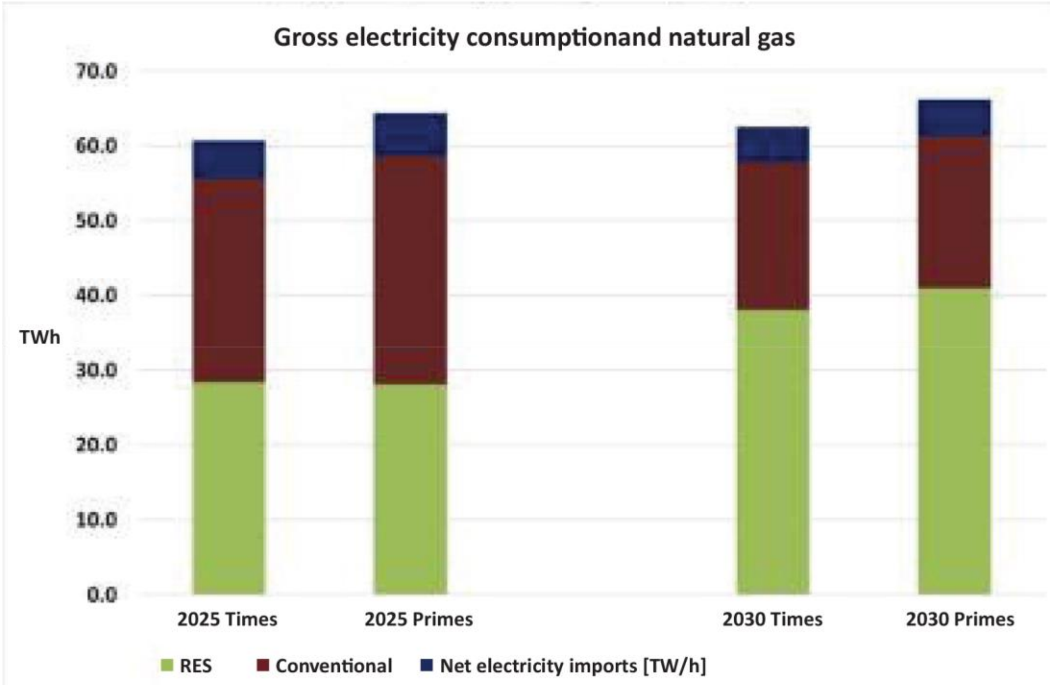


Chart 51: Gross electricity consumption mix between different simulations (TIMES – PRIMES).

In terms of quality, however, what is important about the evolution of the energy system is that the results of both energy models estimate an increase in demand for electricity consumption in the period 2021-2030, which could be significantly higher if not offset by improving the energy efficiency of systems, devices and vehicles. This result is mainly due to the gradual electrification of uses and sectors with heat pumps and electric vehicles having a prominent role at the level of products. Due to the continuously increasing electrification and the expansion of the use of uncontrolled RES, both models simulate the promotion of RES storage and utilisation technologies, such as hydro-pumped, and then batteries. Respectively, the development of RES (especially hydrogen) fuel for large-scale energy storage is estimated to be small by 2030 and is expected to grow further in the long run.

For the share of RES both overall and in individual sectors (Chart 52), the results from the two energy models lead to similar distributions and developments over the period 2021-2030, with only a marginal indication of the share in gross electricity consumption where the level of participation is reversed between the two results from 2025 to 2030. Specifically while this share of participation from the PRIMES energy model was lower than that from the TIMES energy model for 2025, it is estimated that there will be a significantly higher share of almost 64% in 2030.

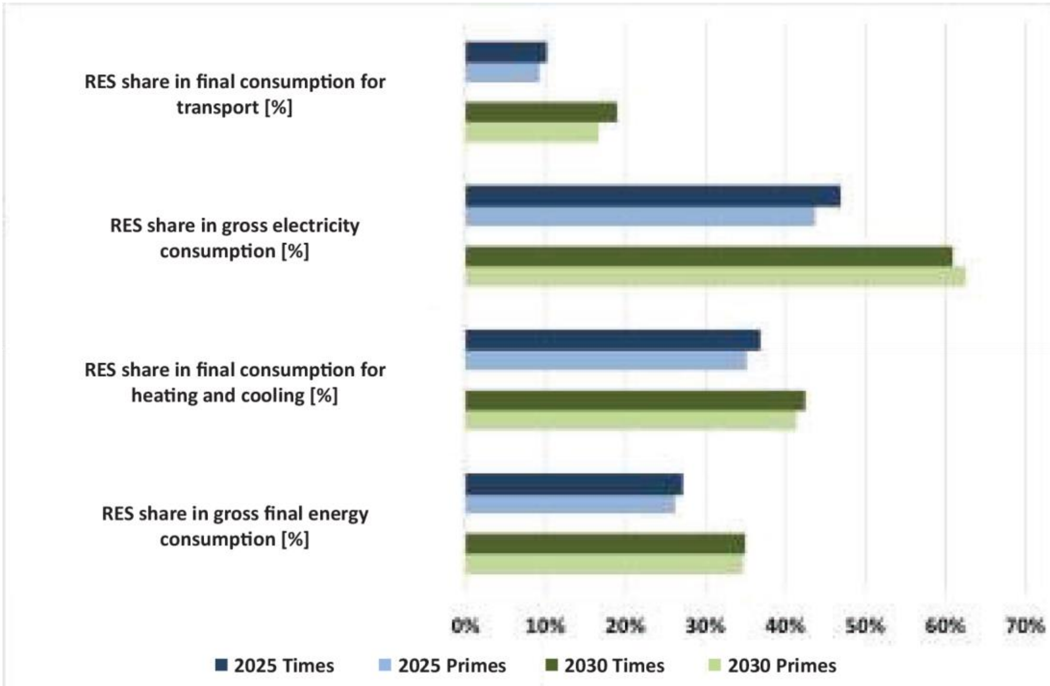


Chart 52: RES shares by sector between different simulations (TIMES - PRIMES).

Concerning the estimates of the future installed capacity of RES technologies (Chart 53), there is a significant convergence between the results of the two energy models, as for the year 2030 the deviation is less than 0.2 GW of installed capacity with an average installed capacity of about 18.8 GW. While, as reported, the overall assessment of RES installed capacity presents an impressive convergence, the individual configuration of installed capacity in RES technologies presents differences that are worth noting and analysing. Initially, it is clear from both energy simulations that photovoltaics and wind farms will be the dominant technologies with a cumulative contribution exceeding 72% of the estimated total installed RES capacity. However, while the installed capacity that results from the two energy models is similar for these two technologies by 2025, they present significant deviations of 1 GW in the year 2030. This is due to the different considerations obtained from the energy simulations regarding the utilisation factor and energy efficiency, especially of the new wind farms where the results from the PRIMES energy model show a significantly higher rate of improvement of the utilisation factor than the one estimated using the TIMES energy model, including a provision for the development of marine wind parks.

Moreover, the installed capacity of hydroelectric power projects and biomass/biogas plants is slightly higher in the long run, according to the results from the PRIMES energy model.

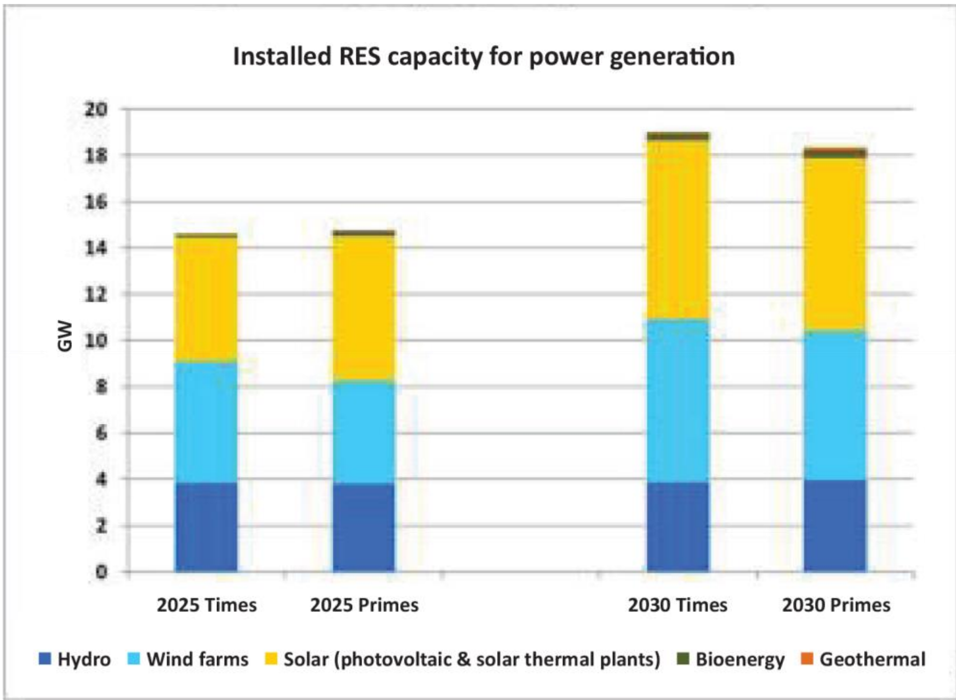


Chart 53: Distribution of installed RES capacity by technology between different simulations (TIMES - PRIMES).

Respectively, at the level of net renewable electricity generation, we first observe a significant increase in total electricity generation from 2025 to 2030 in both simulations (Chart 54). Marginally, total RES generation is reversed between the two results from 2025 to 2030, with the PRIMES simulation forecasting a slightly increased electricity generation of 3% in the year 2030. This increase is mainly due to different assumptions about the levels of electricity in the energy mix as well as possible divergences in the projected flexibility and interconnections in the energy system between the two energy simulations. At the level of electricity generation distribution, the results from the two energy models lead to similar distributions and development between the two years with little difference in the participation of wind parks, bioenergy and hydroelectric power plants.

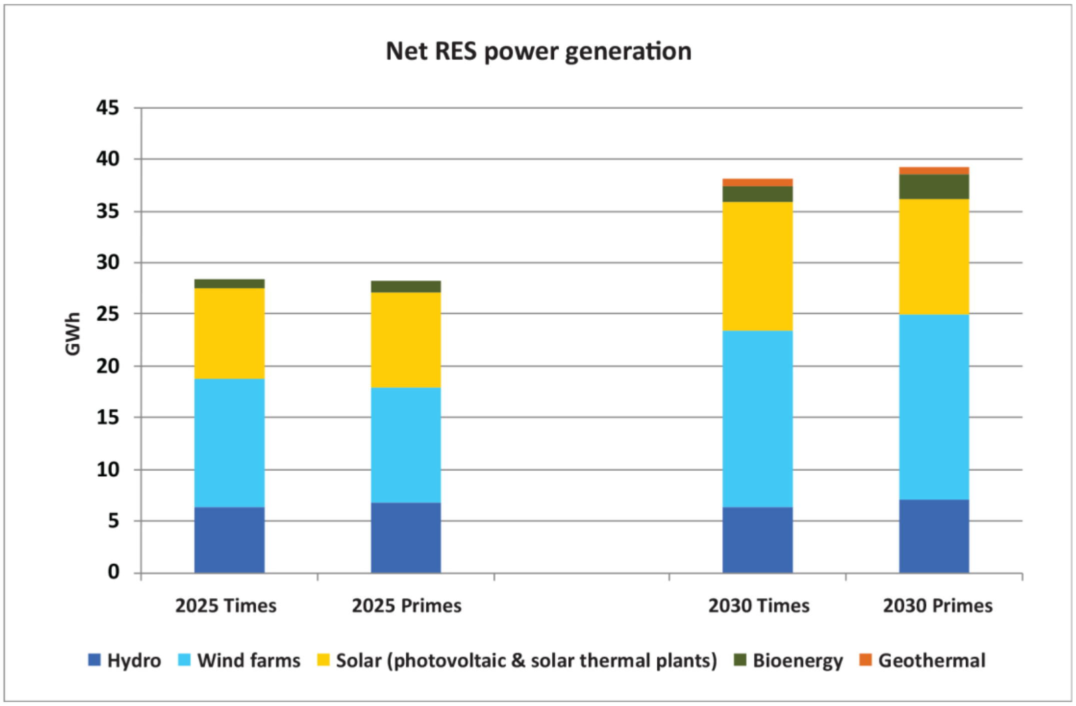


Chart 54: Distribution of net electricity generation by technology between different simulations (TIMES - PRIMES).

Finally, the following graphs present the structure of energy consumption in the end-use sectors (Chart 55) and per fuel (Chart 56) for the two projected years (2025, 2030), as shown by the two energy simulations. The energy simulation of the TIMES energy model takes into account the assumptions of demand structure in each end-use sector, while the energy simulation of the PRIMES energy model calculates inherently the investments in energy consumption and the use of technologies/equipment in the final areas of consumption.

Despite the different approach of the two energy simulations, the estimate for final energy consumption is at similar and stable levels by the year 2030. Energy modelling through the TIMES energy model predicts slightly higher final consumption levels for the year 2030 than that of the PRIMES energy model, which relates to individual higher final energy consumption estimates for the residential, tertiary and transport sectors. Conversely, the estimate of final energy consumption in the industry sector for the year 2030 is presented higher in the results of the PRIMES energy model. Overall, the evolution of the structure of final consumption by end-use sector is small and remains stable until 2030 with the transport sector accounting for the largest share of final consumption in both energy simulations.

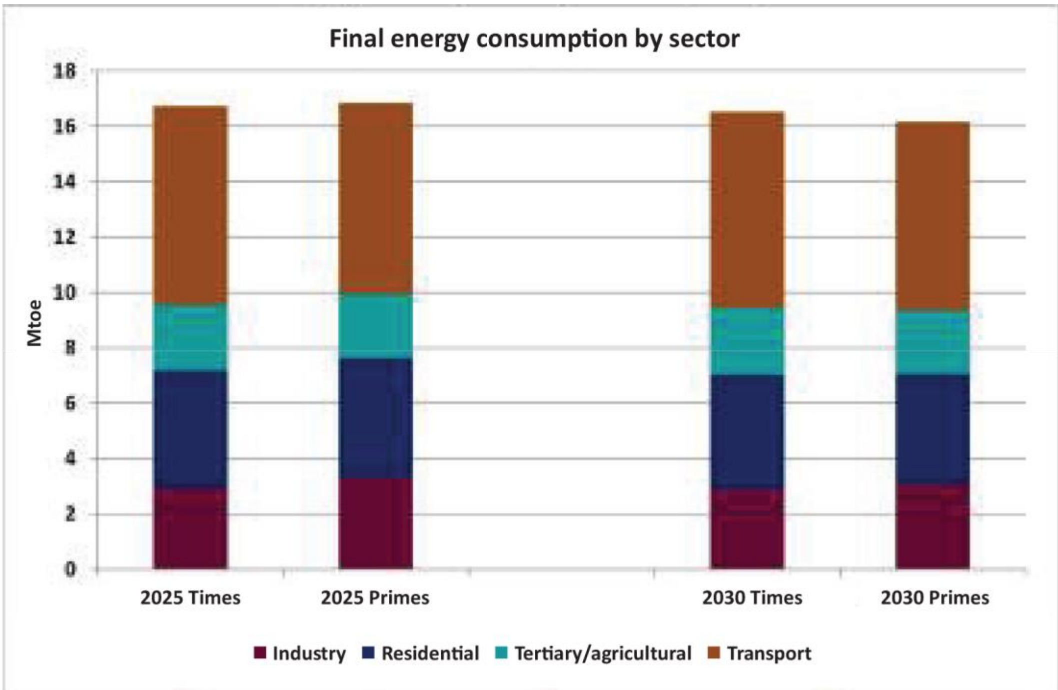


Chart 55: Shaping of final energy consumption per sector by 2030 between the different simulations (TIMES – PRIMES).

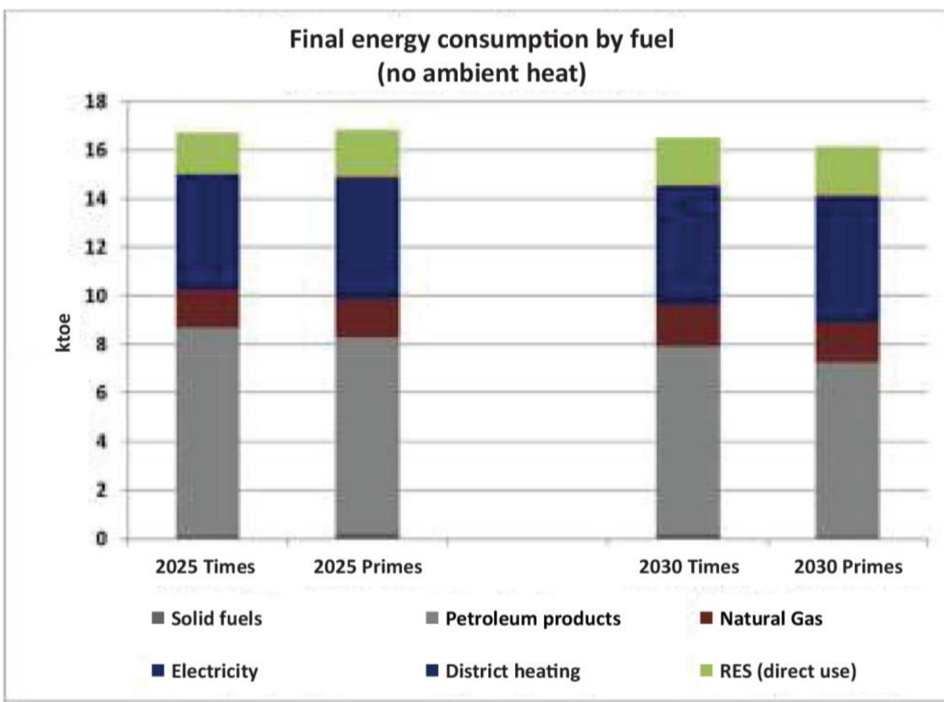


Chart 56: Shaping of final energy consumption per fuel by 2030 between the different simulations (TIMES – PRIMES).

The greatest interest in the marginal differences between the results of the two energy models is perhaps in the distribution of fuels in the final energy consumption, where it is qualitatively evident that the energy simulation result for the year 2030 from the PRIMES energy model estimates a higher participation of electricity both in percentages and absolute figures, in contrast to the result of the TIMES energy model where the share of petroleum products is slightly higher.

Chart 57 presents the forecasts of fuel shares in the final energy consumption sectors based on the energy simulations of the two energy models for 2025 and 2030. The interesting result of this benchmarking is that although there are individual differences in projected fuel shares due to different assumptions about the effectiveness of policy measures and market conditions, there seems to be different roadmaps that finally achieve the same targets. This benchmarking enhances the credibility and consistency of the results of the energy system development by 2030 and enables, through the monitoring mechanism described, the timely and detailed monitoring of the performance of policy measures and of the energy market conditions as they arise over time, including the planning and taking appropriate action to focus policy measures on the roadmap that appears to be evolving based on ex post data.

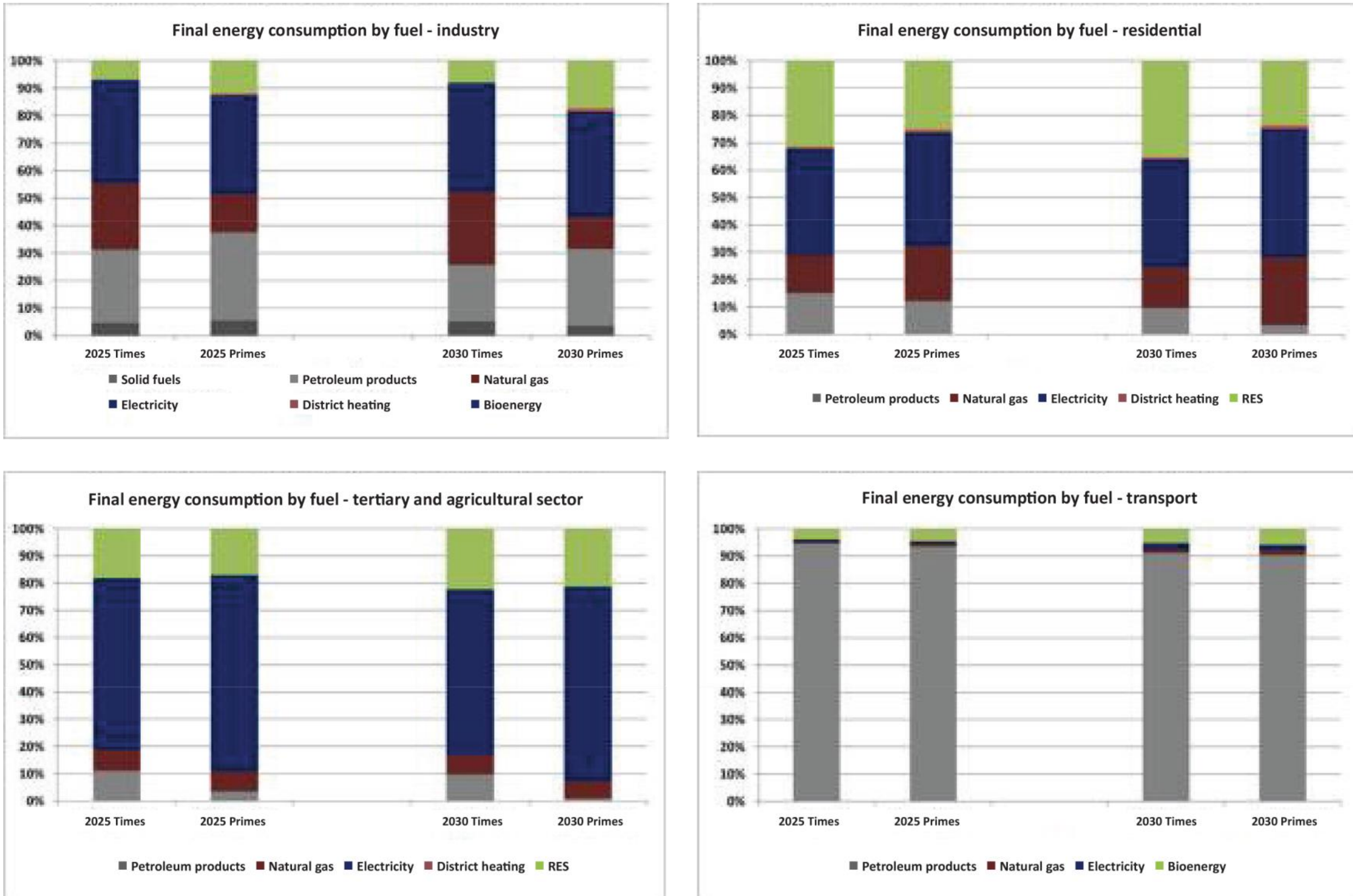


Chart 57: Share of fuel per end sector for the different energy simulations (TIMES – PRIMES).

Chapter 5 OVERVIEW OF IMPACT AND INVESTMENT NEEDS

5.1 Analysis of impact of key national planning policies

A specific methodological approach has been developed in the context of this national plan to assess the socio-economic and environmental impact of implementing the policy measures to achieve national targets in quantitative terms. The purpose of this analysis is to take into account all the impact on the evaluation of the development scenarios in the energy sector, thus contributing to making sure that the NECP becomes coherent and transparent, as required, with respect to all the resulting impact of meeting the energy and climate objectives.

The quantification of the impact under the draft of the national plan on energy and the climate focuses on the impact of the increase of the participation of renewable energy sources on energy consumption and on the measures and policies for the improvement of energy efficiency in the building sector.

The macroeconomic impact of a detailed list of clean energy technologies, RES and energy savings was calculated by means of the input-output method. The input-output tables give a full picture of the flow of products and services in the examined economy for a given year, thus reflecting the relationship between producers and consumers, as well as the interdependencies among businesses. The resulting mathematical formulas permit to examine the impact of a change on one or more economic activities across the economy.

The three different matrices found in a standard entry-exit table are the following:

- table of intermediate consumption
- table of final demand
- primary input matrix

The relevant input-output table for the Greek economy, which includes 65 economic sectors, was used for the analysis. Additionally, the results relate to the gross macroeconomic effects related to the net energy technologies in question and the analysis takes into account the following macroeconomic effects:

- Investment effects linked with the construction and implementation of various technologies, including the installation of the relevant equipment and materials. This type of macroeconomic effect is provisional and created prior to the investment (feasibility study, planning, etc.) and the implementation phases.

- Effects of the operation and maintenance of the technologies considered. Operating costs also include fuels and electricity used for the operation of the technology considered. This type of macroeconomic effect is permanent and lasts throughout the course of the intervention.
- Increased consumption results from the implementation of energy efficiency measures in households following the repayment period. More specifically, this relates to additional available funds for household expenses equal to the economic benefit of energy savings. This creates additional demand for products and services, resulting in permanent macroeconomic effects in the period considered.

The analysis does not take into account any effects from the reduction in the activity of traditional/conventional energy economy sectors (e.g. electricity generation, marketing of fuels, etc.), due to reduced energy needs resulting from the energy-saving measures or the replacement of electricity generation by fossil fuels.

In addition to the macroeconomic effects of clean energy, its impact on public health was also calculated. Air pollution is an serious cause of death and disease around the world. Health effects include an increase in hospitalisations and an increased risk of premature death. In the context of this analysis, the reduction of emissions is quantified by measure, comparing its performance (based on the resulting emissions) with a situation where the measure is not implemented (base-case scenario).

Disability-Adjusted Life Years (DALY) have been used widely since the 1990s to assess the international and/or regional burden from diseases. Given the effects of atmospheric pollutants on human health, the DALY measurement is also used as an indicator for the quantification of the health impact of environmental pollution associated with the burden from diseases. Therefore, in this analysis, the quantification of the benefit from the implementation of the analysed clean energy technologies uses DALY.

In accordance with the World Health Organisation (WHO), a DALY can be considered as a lost 'healthy life' year. The DALY is calculated as the sum of the Years of Life Lost (YLL), due to premature mortality in the population and the Years Lived with Disability (YLD) for people who have a specific health condition.

On the basis of the results of these analyses on the socio-economic impact and according to the quantitative data of the objectives achievement scenario, total new investments in the field of electricity generation from RES is expected to result in benefits in domestic added value exceeding EUR 12 billion throughout the operation of such systems. Similarly, there are many benefits to creating direct and indirect jobs due to the development and operation of these projects, as it is estimated that more than 37 thousand new full-time jobs will be created and maintained on a yearly basis throughout the relevant period. The impact on the income of involved employees is also particularly significant, as the implementation of related policies and measures will bring about an increase of EUR 5 0.5 billion. With regard to the effect on public health, the expected benefit is quantified at 19.5 thousand DALY on an annual basis.

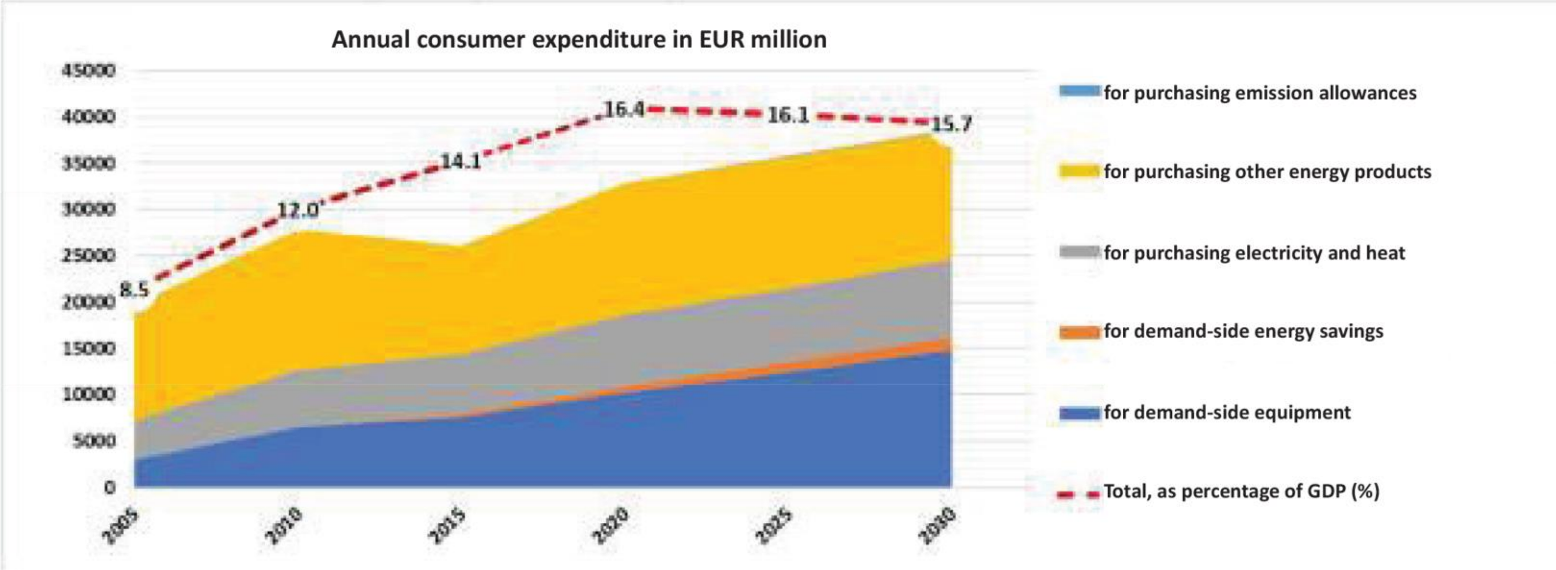
The key priority of planning with regard to the improvement of the energy efficiency of the building stock in the country is to generate significant macro-economic benefits for the country. The energy upgrade of 15% of Greek homes in the decade 2021-2030 as well as the improvement of the energy efficiency of the building stock by means of interventions in the building envelope, are expected to lead to an increase of more than EUR 8 billion in domestic added value and to the creation and maintenance of more than 22 thousand new full-time jobs annually throughout the year. The increase in the income of involved employees is expected to reach approximately EUR 3.4 billion, and the expected benefits for public health are expected to exceed one thousand DALY on a yearly basis. It should be noted that these estimates are expected to be significantly higher if the effects of investments in more efficient equipment on heating and cooling systems and other appliances are taken into account.

Overall, Table 43 presents the estimated impact caused by the projected RES penetration and energy upgrading of the building sector by 2030.

Table 43: Impact assessment of RES penetration and energy upgrading of the building sector by 2030.

Impact	RES	Energy upgrading of buildings
Increase in domestic added value throughout the lifecycle of the interventions (EUR billion)	12.6	8.1
Increase in the income of involved employees throughout the lifecycle of the interventions (EUR billion)	4.8	3.4
Increase in full-time jobs on a yearly basis (thous. jobs)	37.4	22.0
Public health benefit annually (thousand DALY)	19.5	1.1

The above effects are due to the increase in investment over the period 2021-2030 (Chart 58), as identified by the PRIMES model. Expenditure on energy efficient equipment and energy savings is growing at a faster rate than spending on purchasing energy products, while total spending on final consumers is reduced as a percentage of GDP in the period 2021-2030. Annual investment expenditure remains at relatively high levels in all sectors in the 2021-2030 decade, with buildings and transport spending accounts represent the highest percentage.



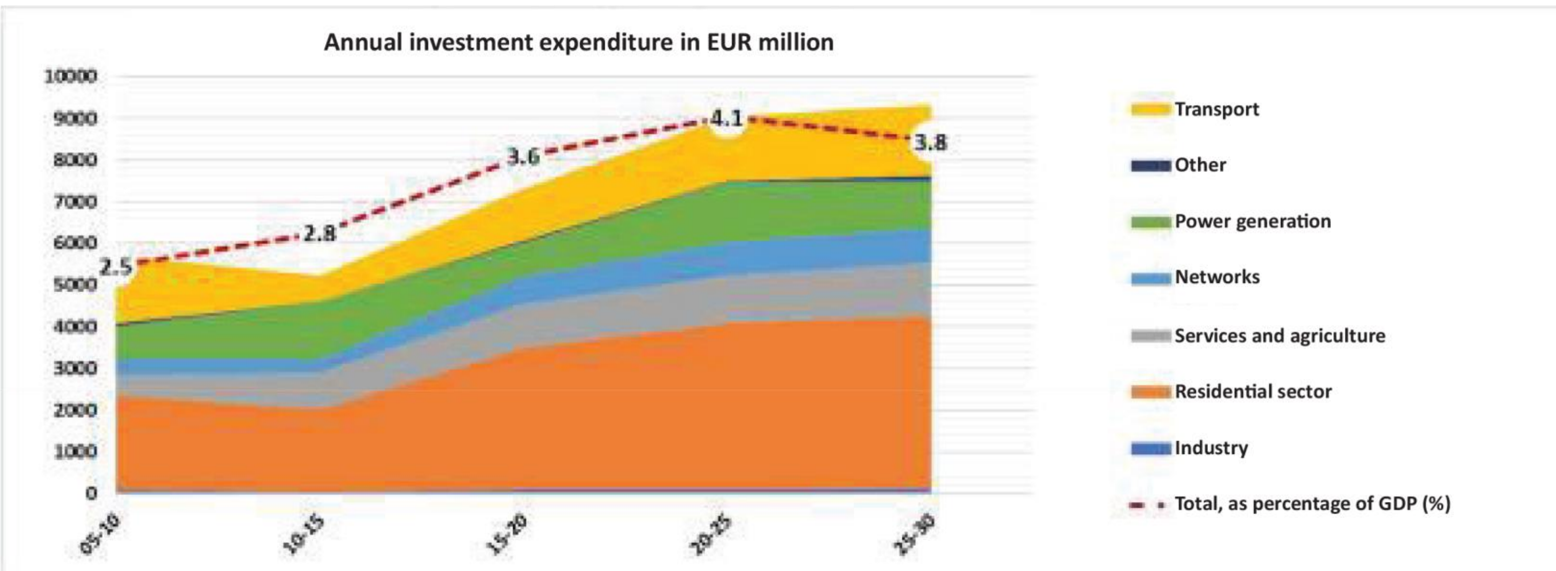


Chart 58: Evolution of investment expenditure by 2030.

It is particularly important that, as a result of the energy simulations, the average cost of electricity generation is reduced during the period 2020-2030, despite the radical change in the electricity generation mix. Moreover, Chart 59 shows the evolution of the various strongly differentiated components of electricity costs. Specifically, the fixed cost of capital and maintenance of plants as well as the average cost of networks are increasing, while the variable fuel and operating costs are significantly reduced.

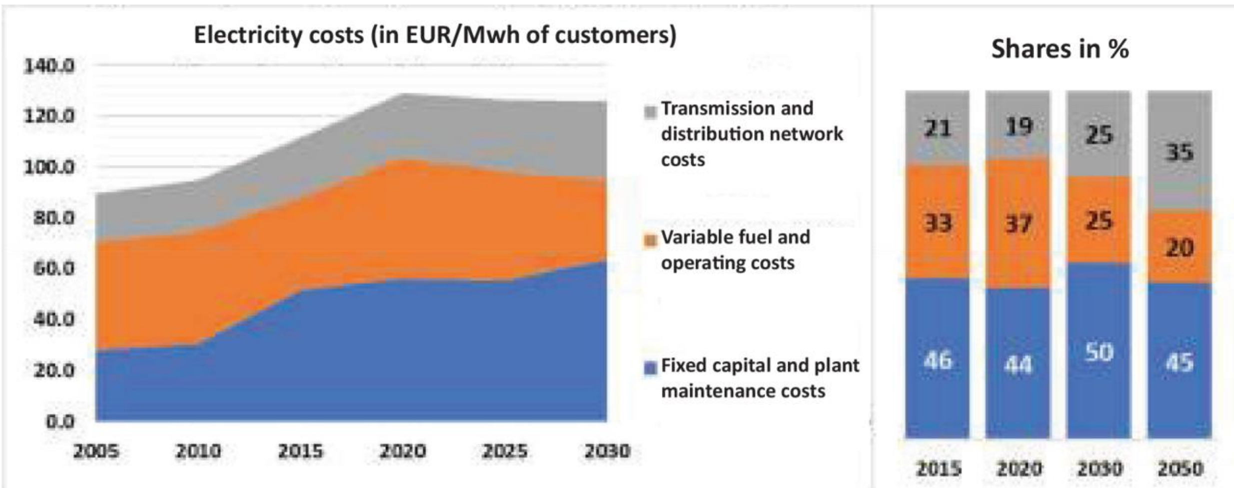


Chart 59: Evolution of electricity costs by 2030.

A key conclusion from this analysis is that the energy transition in the electricity sector is achieved by keeping the average cost of electricity generation stable. The result of this simulation demonstrates the economic competitiveness of the objectives and policies outlined, even at the short and medium term, where, while achieving significant environmental and development benefits, there seems to be no burden on consumers in the context of this energy transition.

The impact of energy-saving investments is illustrated by the evolution of energy intensity in the final energy consumption sectors (Chart 60). In fact, policies to improve energy efficiency have succeeded in cancelling the restoration of energy intensity to the pre-crisis levels by offsetting the tendency to increase energy consumption.

The improvement in the indicator in the period 2021-2030 is higher in the case of industry and the tertiary sector (decreasing by 25% and 22% respectively), while for the residential and transport sectors, the decrease is 18% and 11%, respectively.

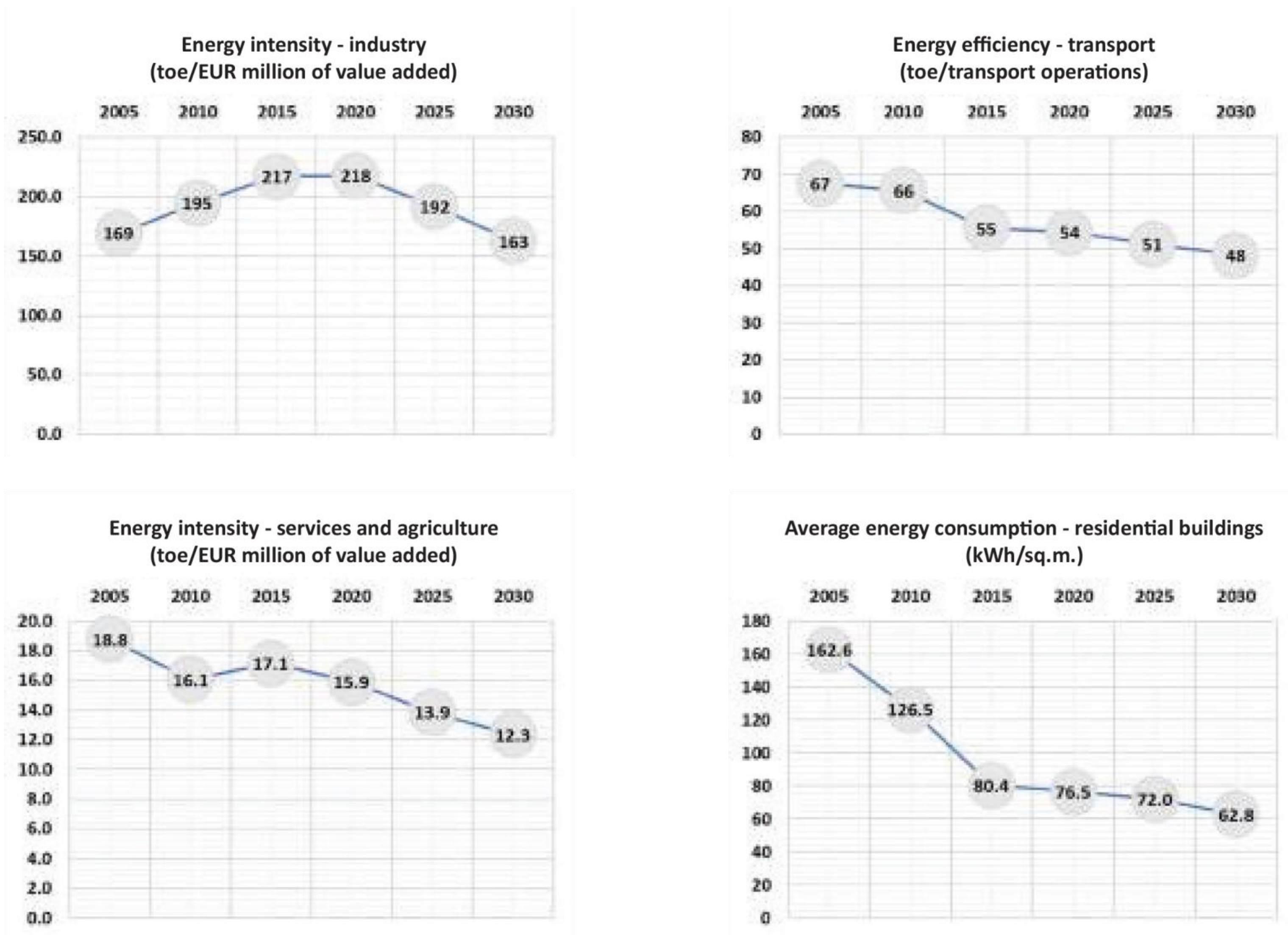


Chart 60: Evolution of the energy intensity of the final energy consumption sectors under consideration by 2030.

5.2 Existing investment flows and planned investment assumptions regarding planned policy measures

Achieving medium-term and long-term national objectives through policy measures in key energy and climate fields as detailed above, will result in significant investments in the development of the country by means of enhancing competitiveness in the economy and in employment.

The provision for expected investments in the period 2020-2030, in the basic planning axes of the NECP, is shown in Table 44. These investments are expected to contribute significantly both to national economy and to the protection of consumers from price fluctuations in energy products, through the reinforcement of competition in energy markets.

Table 44: Estimation of investments in the key areas of the National Energy and Climate Planning.

Sector	Total estimated investments (€ million) for the period 2020-2030
1. Electricity generation from RES	9,000
2. Electrical system infrastructure	5,500
3. New thermal electricity generation plants and central storage plants	1,300
4. Works for the development of an electricity distribution network – Digitisation	3,500
5. Cross-border natural gas pipelines	2,200
6. Natural gas networks and storage	2,000
7. Research and innovation	800
8. Energy efficiency	11,000
9. Investments in the refinery sector	1,500
10. Climate change, flood management, forests	2,000
11. Circular economy, recycling	5,000
TOTAL	**43,800**

A key tool to support these investments, at least in certain categories of investment measures, will be the new programming period 2021-2027, on the basis of which appropriate financing programmes must be ranked, also taking into account the analysis of available resources.

The essential characteristics of the new Programming Period 2021-2027 are the following:

I. The existence of necessary appropriate conditions (replacing the ex ante conditionalities of the current period), some of which relate to the energy sector. The fulfilment of the necessary appropriate conditions shall be monitored throughout the programming period and any delays in said fulfilment may create difficulties in the financing of the corresponding projects.

II. The increase in the significance of reimbursable aids (given by means of financing tools) and the tendency to reduce grants. The increased use of financing tools will result in an increase in available resources for implementing certain categories of energy projects, thanks to the leverage and recycling of resources. Furthermore, it is made possible to combine resources from Funds with other resources in order to facilitate the financing of the projects.

In this context, and according to the proposal of the European Commission on the Multiannual Financial Framework, EUR 19 138 million in constant 2018 prices, or EUR 21 582 million in current prices, are allocated to Greece for the period 2021-2027. These funds are provided by the European Social Fund, the European Regional Development Fund (ERDP), the Cohesion Fund and the European Territorial Cooperation.

In particular, according to the above proposal, available funds for the ERDF correspond to EUR 10 222 million in constant 2018 prices and for the Cohesion Fund to EUR 3 578 million.

The proposal for a regulation concerning the ERDF and the Cohesion Fund stipulates that, for countries with a gross national income lower than 75% of the EU average, at least 30% of ERDF resources must be used for Policy Objective 2[23], pertaining to energy, the climate and the environment. A significant proportion of the Cohesion Fund resources (around 50%) is expected to be allocated to Policy Objective 2.

[23] 'Greener, low-carbon Europe, by promoting clean and fair energy transition, green and blue investment, the circular economy, climate adaptation and risk prevention and management.'

Therefore, it is expected that at least a minimum of EUR 3 066.6 million (at constant 2018 prices) from the ERDF and approximately EUR 1 789 million from the Cohesion Fund (at constant 2018 prices) will be available for this Policy Objective.

The rates of co-financing by category of regions for the ERDF, as suggested in the Common Provisions Regulation, are as follows:

- 70% for the least-developed
- 55% for transition regions
- 40% for the more developed

Please note that all Greek regions fall into the first category, except for Attica and the South Aegean, which are classified as transition regions.

The rate of co-financing for the Cohesion Fund as proposed in the Common Provisions Regulation is 70% for all regions.

According to the draft Common Provisions Regulation, given that Greece's regions are among the least developed and transition regions, 81.2% of the ERDF resources are allocated to the least developed regions and 18.8% to the transition regions. In view of the above, an estimate is made of the public resources (EC and national) available for Policy Objective 2. These resources amount to EUR 7 161.2 million at constant 2018 prices.

Because of the non-binding timetable for the completion of the negotiation on the regulatory framework, the negotiation on the partnership agreement, and the submission and approval of the programmes, the approval of the programmes of Cohesion Policy 2021-2027 is expected after the first half of 2021. Taking into account the adjustment period of the national institutional and organisational framework, the programmes are expected to be activated at the beginning of 2022.

The amount of funding available for the implementation of projects in the Energy Sector and prevention, adaptation and response to climate change will be announced following the adoption of the Operational Programmes in the first half of 2021 and will depend on the maturity of the projects, their compatibility with eligibility rules and their timely preparation, submission and integration.

As already mentioned, the actions/projects to be financed in the Energy and Climate Change Sector are primarily integrated in Policy Objective 2. The specific objectives supported by the ERDF and the Cohesion Fund (in particular circular economy, sustainable development and RES investment) under this Policy Objective are the following:

I. promoting energy efficiency measures

II. promoting renewable energy sources

III. developing smart energy systems, networks and equipment for storage at local level

IV. promoting the adaptation to climate change, the prevention of risk, and resilience to disasters

V. promoting sustainable water management

VI. promoting the transition to a circular economy

VII. strengthening biodiversity and green infrastructure in the urban environment, and reducing pollution.

Restrictions in eligibility result from Article 6 of the ERDF and the Cohesion Fund draft regulation, as well as the intervention areas suggested in the Common Provisions Regulation draft with regard to Funds. In particular, the ERDF and the Cohesion Fund do not support, inter alia, 'investments related to the production, processing, distribution, storage or burning of fossil fuels'. The above limitation, at the present stage of the negotiation, excludes investments in (i) replacement of coal heating systems with natural gas heating systems, (ii) distribution and transportation of natural gas for carbon substitution and (iii) clean vehicles as defined in Article 4 of Directive 2009/33/EC of the European Parliament and of the Council'.

The intervention areas indicated in the Common Provisions Regulation draft and pertaining to a low-carbon economy are the following:

- ✓ Energy efficiency and demonstration projects in SMEs and supporting measures
- ✓ Energy efficiency renovation of existing housing stock, demonstration projects and supporting measures
- ✓ Energy efficiency renovation of public infrastructure, demonstration projects and supporting measures

- ✓ Support to enterprises specialised in providing services which contribute to a low carbon emissions economy and to resilience to climate change
- ✓ Renewable energy: wind
- ✓ Renewable energy: solar
- ✓ Renewable energy: biomass
- ✓ Renewable energy: marine (wave, tidal).
- ✓ Other renewable energy sources (including geothermal energy).
- ✓ Smart Energy Distribution Systems at medium and low voltage levels (including smart grids and ICT systems), and relevant storage systems
- ✓ High efficiency co-generation, district heating and district cooling.
- ✓ Support to environmentally-friendly production processes and resource efficiency in SMEs
- ✓ Adaptation to climate change measures and prevention and management of climate-related risks: floods (including awareness raising activities, civil protection and disaster management systems and infrastructures).
- ✓ Adaptation to climate change measures and prevention and management of climate-related risks: fires (including awareness raising activities, civil protection and disaster management systems and infrastructures).
- ✓ Adaptation to climate change measures and prevention and management of climate-related risks: other risks, e.g. storms and droughts (including awareness raising activities, civil protection and disaster management systems and infrastructures).
- ✓ Water management and water conservation (including river basin management, specific climate change adaptation measures, reuse, leakage reduction).

- ✓ Management of household waste: prevention, minimisation, sorting, recycling measures.
- ✓ Management of household waste: mechanical biological treatment, heat treatment.
- ✓ Promoting the use of recycled materials as raw materials.

Electricity transmission infrastructures, with a focus on island interconnections, are also being funded in the aforementioned context to facilitate further development of RES, as well as interventions to promote the equitable transition of lignite areas and the promotion of the circular economy.

In addition, Policy Objective 3[24] promotes, inter alia, investments in 'Clean urban transport infrastructure', which may include electric infrastructure in urban environments.

An additional source of funding for the NECP may be the national resources of the Public Investment Programme (RIP). From the perspective of transforming the RIP into a National Development Programme (NDP), actions and projects related to energy and climate may be priorities of this programme in the context of the country's national development goals and in line with the principle of complementarity with European Union co-financed interventions and the effectiveness of policies and commitments undertaken by the country over specific periods.

Additional resources for actions related to energy and climate change may be raised in the period 2021-2027 from the Rural Policy Programme, as well as other funds (Asylum, Migration and Integration Fund - Internal Security Fund - Borders and Visa).

Moreover, under the 'sustainable infrastructure' policy area of the Invest EU programme set up by the European Commission to integrate the financial allocations for loans and guarantees within its long-term budget (2021-2027), it is possible to also finance actions/projects related to the energy sector that are expected to contribute significantly to leveraging resources.

[24] 'A more connected Europe by enhancing mobility and regional ICT connectivity'

Finally, financing of actions of the Energy Sector may also be included in Policy Objective 1[25], through which actions of the Energy and Climate Change Sector related to Research and Innovation (e.g. actions involving new, sophisticated energy storage systems, new materials, etc.), entrepreneurship (e.g. measures to upgrade energy for small and medium-sized enterprises) and ICT (e.g. incentives for digital businesses in the field of energy data, etc.)

In addition to the resources for the programming period 2021-2027, which are one of the main funding instruments of the objectives of the national energy and climate plan, the NSRF 2014-2020 will also contribute towards this direction, through which projects are funded towards a transition to a low-carbon economy with significant public spending resources of around EUR 2 0.5 billion. These projects are related to energy saving and energy efficiency improvement activities in all sectors (residential, public, tertiary, secondary), promotion of thermal renewable energy and electrical renewable energy using a funding instrument (Infrastructure Fund), as well as projects for the interconnection of islands (Cyclades, Crete), modernisation and expansion of the electricity and gas transmission and distribution network.

Funds from the Connecting Europe Facility (CEF) are also being used to finance major energy infrastructures (Common Interest Projects), which will be used in the coming period with the expansion of Energy Sector eligibility, including, in addition to Common Interest Projects, cross-border cooperation projects in the field of RES generation, as well as smart grid applications.

The combination of the above funding with national programmes, through which complementary actions (e.g. ‘Electra’ programme, national programme for development (Law 4635/2019), which contribute to the transition to a low-carbon economy (energy efficiency, RES, energy infrastructure), are financed, as well as the exploitation of market mechanisms (e.g. RES operating support, enforcement schemes), will activate funds for the implementation of related projects.

Analysing and mapping the funding gap, designing and developing new financing schemes and financing instruments and making the most of them by appropriately leveraging the available resources while also mobilising private capital will lead to significantly investments of a significantly greater budget from the funds available through Community and national programmes, effectively contributing to the achievement of the Energy and Climate Policy objectives.

[25] ‘A smarter Europe by promoting innovative and smart economic transformation’

5.3 Assessment of the interaction and the impact of energy-efficiency/energy-saving policies

Based on a bottom-up approach, considering the demand in energy generation, it is easily understood that planning aiming to the improvement of energy efficiency as regards final demand and energy generation and distribution, may help to achieve the national and, by extension, the European objectives on energy and the climate in the most cost-effective manner.

The improvement of energy efficiency in this plan is considered a horizontal priority, and the related measures complement the other basic aspects of the planning.

Regarding the climate dimension, energy efficiency improvement measures contribute significantly in achieving a reduction in greenhouse gas emissions. As for renewable energy sources, measures for the improvement of energy efficiency are of primary importance for meeting the targets associated with the use of RES in cooling and heating and in transport. As regards security of supply, it is clear that the improvement in energy efficiency and the resulting decrease in demand leads to reduced energy dependency of the country, while measures based on demand response are already in force both for electricity and natural gas. With regard to the aspect of the internal energy market, in the context of the measure for the Development of Energy Transport-Distribution, actions will be implemented for infrastructure managers to improve the energy efficiency of infrastructure, aiming to improve energy efficiency in transport, distribution, load management and the interoperability of networks. In addition, the measures for the improvement of energy efficiency in vulnerable households are essential for dealing with the phenomenon of energy poverty.

The recognition of the value of energy efficiency as a good practice functioning in a complementary and horizontal manner as regards the promotion of the energy and social objectives of the country is undeniable and demonstrated by both the good practices implemented so far and the way that this aspect is handled in the planning.

Good practices that have been followed to date aiming to the horizontal promotion of energy efficiency:

- ✓ **Use of resources in the operation of the European Emissions Trading Scheme (ETS):** Part of the resources of the financing tool from the European Emissions Trading Scheme (ETS) is used to promote energy efficiency measures and policies by means of improving the conditions of financing such actions.
- ✓ **Synergies between RES and minimum energy performance requirements for buildings:** All new and fully renovated buildings must meet with RES 60% of their needs for domestic hot water.
- ✓ **Implementation of low discount rates:** To determine the minimum energy performance requirements for buildings and review the related regulation, the country has set the main discount rate at 3%, taking into account the social aspect of the cost-benefit analysis, recognising the multiple non-energy benefits of energy efficiency measures.
- ✓ **Implementation and dissemination of stricter energy efficiency policies:** The country has implemented energy efficiency schemes, which are a policy framework that mobilises electricity and natural gas providers, but also providers of petroleum products, to implement energy efficiency measures.

Approaches in the context of the national plan for energy and the climate, for the horizontal promotion of energy efficiency:

- ✓ **Ambitious energy efficiency targets:** (a) Objective to achieve energy savings in final energy consumption, at 38% compared to the forecast on final energy consumption by 2030 and to achieve lower final energy consumption in 2030 compared to that in 2017; (b) Energy upgrade of 12-15% of the building stock by 2030.
- ✓ **Macroeconomic effects of energy efficiency technologies:** In the context of the national plan for energy and the climate and with a view to maximising the non-energy benefits of energy efficiency measures, the impact of key energy efficiency technologies in the sector of employment, on the increase in domestic added value, on revenue and the health of the citizens of the country, was assessed and taken into account.
- ✓ **Optimisation of synergies between RES and energy efficiency:** Aiming to the optimal planning of energy efficiency policies, RES policies for heating and cooling, and RES policies in transport, through the study and analysis of a portfolio, the appropriate and optimum combinations of policies were determined, to achieve all related sub-objectives set in the context of the planning, whilst minimising the costs and the risk of the implementation of said objectives.

5.4 Risk factors and challenges

Based on the structure of the above chapters, beginning with policy objectives, policy guidelines have been set out, complemented by a series of policy measures which may be classified as regulatory and technical. Focusing on technical measures, those usually pertain to the implementation of a technological intervention, which is inevitably accompanied by the mobilisation of investment costs, regardless of who takes up this burden. Therefore, for each policy measure, different combinations may apply regarding the undertaking of the financial burden of the investment for the implementation of the same technology.

The selection of the most suitable financial mechanism and instrument, as well as the distribution of the financial burden of each policy measure is a matter directly and closely linked to the success of the implementation of said measure. Therefore, the key planning principles with regard to the taking up the financial burden of the various stakeholders is a process still not placed in the centre of energy planning.

The key principles of energy planning include the optimisation of the relation between the cost and the results of policy measures, while defending the interests of all stakeholders and keeping the risk of implementation failure at the lowest possible levels. Therefore, policy measures are being planned and will be implemented for a more efficient management of the structural funds and the national objectives, aiming to the maximum mobilisation of private funds, both from investors and benefitting citizens or businesses, as appropriate. However, in order to achieve that objective, a series of financing mechanisms and instruments will be used, with the ultimate goal of creating appropriate conditions to attract investment, combining different sources of financing, and optimising the efficiency of state funds.

In particular, optimising the return on state funds will be achieved by reducing subsidies and granting preferential loans instead of allowing recycling of funds (grants) through special funds, as well as through the creation of financing instruments by selecting, where appropriate, the appropriate combination of grants and loans and combining funds from various sources (Structural Funds, other European resources and mechanisms, national resources, market mechanisms, etc.)

Similarly, conditions to attract investments will be created, first, through an appropriate regulatory framework and, secondly, through reasonable rules governing the implementation of each measure. The mechanisms to be considered for enhancing this framework shall include security for first losses from loans, an increase in scale, especially for small projects, by means of aggregation, the standardisation of processes and methodologies to reduce the risk of the parties involved in the case of projects which are hard to manage, the establishment of decentralised or central structures for technical support, the removal of legislative and regulatory obstacles, compliance with transparent and non-discriminatory procedures, which may or may not be competitive, and the implementation of tax incentives.

An important challenge is to reduce the risk of not achieving the energy efficiency target set for 2030. Failure to keep final energy consumption at projected levels may jeopardise the quantitative targets set for promoting RES in 2030. In such a case, it will be required to install additional RES plants to generate electricity, to introduce a larger number of RES technologies for heating and cooling, and to find more biofuels, in order to achieve the projected RES penetration targets and corresponding ones. Moreover, the energy security dimension will also be affected, as there will be significant problems with the adequacy of available power and power outage due to the higher availability of gas and electricity required compared to the original design of the respective operators.

To avoid this, energy efficiency in schemes will be given greater weight, which will lead to the implementation of energy saving projects through energy efficiency contracts by energy service companies and public-private partnerships, and priority will be given to the implementation of targeted market mechanisms in order to improve energy efficiency. One such mechanism is the existing energy efficiency obligation regime, which will continue to apply until 2030 with the necessary modifications to the regulatory framework improving both the operation and the efficiency of the scheme. Thus, by looking at the achievable techno-economic potential of energy savings in the areas of activity of the obliged parties and the mix of alternative policy measures, target allocation to obligated parties will lead to more equitable and efficient achievement of the objectives. At the same time, the further expansion of the existing scheme will be explored through the operation of a mechanism similar to the one of white certificates with virtual energy equivalents, so that the potential of autonomous actions is available for exploitation by the obligated parties by increasing the potential of the scheme and increasing the alternatives for achieving the energy saving objective. Towards this end, the introduction of competitive energy-saving bidding processes is expected to give significant impetus to improving energy efficiency in specific sectors, such as the tertiary and industrial sectors, significantly improving the cost-effectiveness of the technologies applied, while significantly reducing the risk of implementing the measures. What is more, alternative payment mechanisms for projects between various stakeholders will be investigated, such as payment by means of bills or taxes, any regulatory obstacles will be removed, and the granting of tax incentives to facilitate further energy upgrade actions will be considered. Finally, specific schemes will be explored to tackle energy poverty either through existing policy measures or new ones while utilising both available funding programmes and market mechanisms in line with the requirements of the Energy Efficiency Directive.

Accordingly, infrastructure projects will continue to be supported with co-financing from structural funds, whereas, as mentioned above, the main instruments for electricity generating RES stations will include the operating aid scheme and the extended use of competitive procedures, so that the expected private investments may have an increasingly smaller impact on financial support and that the new projects achieve, also depending on market evolution, positive results as regards the reduction of energy costs for consumers.

However, emphasis will be placed on support from investment funds, so that access to financing may be achieved under more competitive terms and that the number of investment plans with access to such financial conditions increases.

With regard to RES in the areas of heating, cooling and transport, a more efficient use of the programmes of the new financial period 2021-2027 will be attempted, in conjunction with holistic interventions, especially in energy efficiency matters, whereas the objective for strengthening domestic sophisticated fuels production is to plan special actions which will focus on everything, from the development of appropriate supply chains to production.

The monitoring mechanism of policies and measures implemented will initially focus on monitoring the evolution of final energy consumption and the implementation of policy measures designed to improve energy efficiency. The purpose of this process is to identify any possible energy balance deviations from what is considered in this plan, which will result from the change in the consumption pattern and its conversion to the corresponding one prior to the onset of the economic downturn due to the improved economic circumstances.

Finally, it is crucial for the success of this project to achieve specific milestones in 2020, which will ensure the smooth and effective implementation of the envisaged policy measures.