

# An Assessment of final NECPs in South East Europe

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*Policy note*

*How do the NECPs of Bulgaria, Greece and Romania stack up against long term  
decarbonisation targets in the energy sector?*

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# IMPRESSUM

**Delivered** by Klimapolitika Ltd. to Agora Energiewende

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## Disclaimer

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## 1. Introduction

The final National Energy and Climate Plans (NECP) submitted to the European Commission by Bulgaria, Greece and Romania have improved in terms of their contributions to addressing climate mitigation compared with their draft versions. The plans have taken on board the recommendations of the Commission. In particular, the NECP of Greece stands out within the region in terms of phasing out lignite from the electricity system and through the achievement of a high share of renewables in electricity and heating and cooling.

However, although all three final NECPs comply with expectations formulated in the Effort Sharing Regulation and reference points set out according to the Governance Regulation, the efforts of Bulgaria and Romania in particular fall far short of making a significant contribution towards long term decarbonisation and a net zero emissions target for 2050. These two countries achieve little or no emission reductions in the non-ETS sector by 2030 and only low shares of non-traditional renewables (i.e. renewables other than large scale hydro in the electricity sector and biomass in the residential and commercial sector) are achieved by 2030. There is some lack of clarity with respect to the role of solid fuels and natural gas in both NECPs which makes it difficult to assess the effort to transition away from fossil fuels towards low carbon energy sources. However, it seems that both countries will be making investments in assets in coal and natural gas which may become stranded. In addition, Romania is betting on the expansion of the Cernavoda nuclear power plant by one unit by 2030 which is unlikely to materialise.

Emission trajectories of both NECPs suggest that Romania and Bulgaria are delaying efforts to transition to a low carbon economy to beyond 2030, which results in a very steep emission reduction trajectory between 2030 and 2050. This is not cost-optimal and endangers the 2050 net zero emission target of the EU.

Although the Effort Sharing Regulation allows Bulgaria and Romania to achieve little or no emission reduction in their non-ETS sectors, it is recommended that all three countries in the South East Europe (SEE) region take advantage of the opportunities offered by the Multi-annual Financial Framework (MFF) to fund investments in a low carbon economy in the period 2021-27, and front load efforts to reduce emissions to avoid a later steep emission reduction trajectory which would entail higher costs.

## 2. Bulgaria

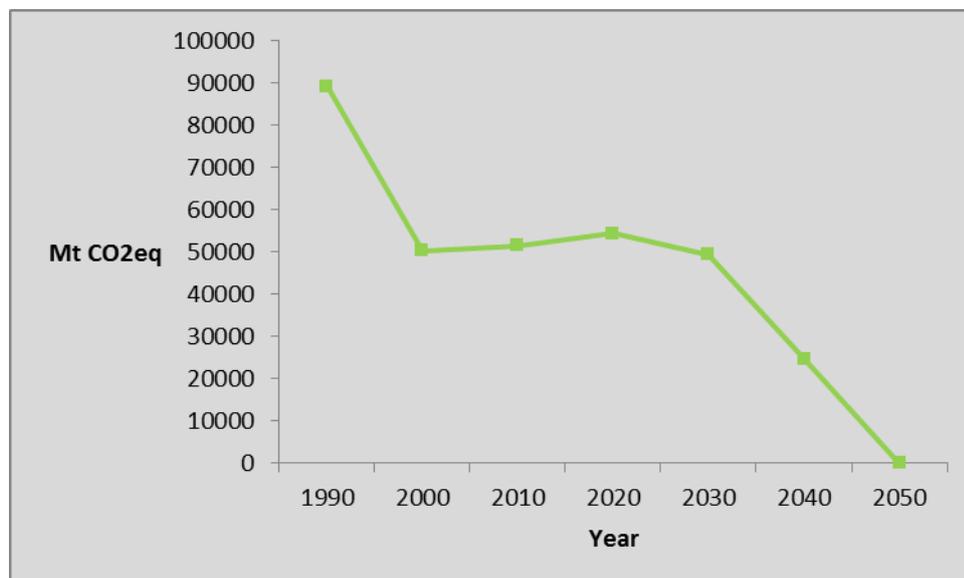
### 2.1. Decarbonisation

#### 2.1.1. GHG emissions

The final NECP of Bulgaria foresees a reduction in greenhouse gas emissions from energy from 45.664 MtCO<sub>2</sub>eq in 2020 to 37.592 MtCO<sub>2</sub>eq in 2030, a reduction of around 18% over 10 years. The entire emission reduction is set to come from the ETS sector, as in the draft of the NECP Bulgaria (Ministry of Energy of the Republic of Bulgaria, 2019) set a target of 0% emission reductions for the non-ETS sector, in line with the Effort Sharing Regulation, which remained unchanged in the final NECP. (Ministry of Energy of the Republic of Bulgaria & Ministry of Environment and Water of the Republic of Bulgaria, 2020)

On the one hand, Bulgaria's emissions have increased over the past decade, and a reversal of this trend may prove difficult due to low starting points in certain sectors (e.g. underheating and energy poverty in households, low car ownership, etc.) in comparison to other EU MS. On the other hand, if a net zero target for 2050 is assumed, it is clear that the emission reduction trajectory is gradual between 2020 and 2030, with a very steep emission reduction required between 2030 and 2050 to achieve a net zero target. With declining energy intensity, reduced demand in the aftermath of the COVID-19 crisis, a shrinking population and the potential future adoption of more demand-side oriented measures, there is some potential for reducing emissions more aggressively already in the period 2020-2030.

Figure 1 GHG emission trajectory (incl. LULUCF) of Bulgaria towards a net zero target in 2050\*



*\*only 10-year intervals are shown and linear trajectory is assumed between these points*

Not considering the required long term emission trajectory to achieve net zero emissions in 2050 constitutes a lost opportunity as it burdens the future with the cost of steep emission reductions and ignores the very high availability of EU funds which can support investment in the low carbon economy.

#### 2.1.2. Energy efficiency

Bulgaria plans to decrease primary energy consumption by 27.89 % and final energy consumption by 31.67 % compared to the PRIMES 2007 reference scenario by 2030. In absolute terms, this

constitutes a 5.7% decrease in primary energy consumption compared with 2020, and a small, 3.3% increase in final energy consumption.

Table 1 Primary and final energy consumption targets in the final NECP and the EUCO3232.5 scenario, Bulgaria

	Final NECP, 2020	Final NECP, 2030	EUCO3232.5 scenario, 2030
<b>Primary energy consumption (ktoe)</b>	18 518	17 466	13 414
<b>Final energy consumption (ktoe)</b>	9 985	10 318	8 585

As with GHG emission reductions, the reduction in energy consumption is expected to come entirely from the ETS sector. The main non-ETS sectors (households, services and transport sectors) will jointly slightly increase their final energy consumption, from 7144 ktoe (83081 GWh) in 2020 to 7353 ktoe (85516 GWh) in 2030, an increase of around 3%.

Table 2 Projected Final energy consumption in households, services and transport according to the final NECP (GWh), Bulgaria

	2020	2025	2030
<b>Households</b>	26886	27274	27550
<b>Services</b>	14033	14786	14519
<b>Transport</b>	42162	43594	43447
<b>Total</b>	83081	85654	85516

All three sectors will increase their energy consumption by a small share until 2030 according to the NECP. The EUCO3232.5 scenario indicates higher energy savings potential for these three sectors in the coming decade. Whereas the NECP shows slight growth in final energy demand for the household, services and transport sectors, the EUCO3232.5 scenario indicates a reduction of around 24%, 17% and 3% for the residential, tertiary and transport sectors, respectively.

At the sectoral level, the NECP discusses energy efficiency in relation to buildings in more detail, but other sectors are addressed in less detail.<sup>1</sup> According to the final NECP, Bulgaria plans to renovate 7.9% of its buildings, around 19.0 million m<sup>2</sup> of residential and 3.2 million m<sup>2</sup> of commercial buildings, between 2020 and 2030. A further 37.3% of buildings would be renovated between 2030 and 2050, bringing the share of renovated buildings by 2050 to 45.2%. Considering the net zero emissions target of the EU, which will need to be translated into national net zero or very close to net zero targets, it is clear that a deep renovation of the entire building stock will be required in all member states by 2050, and that therefore a 7.9% renovation target over the next decade is insufficient.

The planned annual energy savings amounting from the building renovation proposed in the final NECP amount to 2.9 TWh/year (249 ktoe/year). BPIE (BPIE, 2016) shows that a significantly higher level of energy savings, 12.8 TWh/year (1100 ktoe/year), is achievable in multi-family buildings alone, even under a BaU scenario. The EUCO3232.5 scenario foresees energy savings of 780 ktoe/year in the residential and tertiary sector by 2030. Both the BPIE study and the EUCO3232.5 scenario draw up a significantly more ambitious energy savings pathway for the buildings sector in Bulgaria than the NECP.

<sup>1</sup> The NECP includes measures for improving energy efficiency in industry and reduction of heat losses, such as the modernization of production processes in small and medium enterprises to combine energy efficiency measures with the commissioning of installations for production of heat and cooling energy from renewable sources to meet the technological needs of the enterprise. Moreover, it includes financial support mechanisms for EE not only in the buildings sector but also in the transport, industrial and public sectors an expansion of EE public procurement.

In order to achieve a cost-optimal renovation pathway for buildings and to ensure that EU funds are used wisely while still available, and the contribution to economic recovery is maximised, it is recommended that Bulgaria increase its ambition related to building renovation.

Total investment need in the household and services sectors has been estimated as EUR 11.8 bn and EUR 4.2 bn, respectively, over the period 2021-2030. The share of direct investment in energy efficiency is low, at only EUR 0.56bn and EUR 0.14bn, respectively. The rest of the investment cost is for upgrading heating equipment, but the NECP does not clarify what share of investment is meant for RES or other equipment (especially for gasification of households).

### 2.1.3. Renewable energy

In its draft NECP Bulgaria proposed a target of 25 % RES share in gross final consumption by 2030. This target is achievable with existing measures. According to the Commission’s assessment of the draft NECP, “this level of ambition is slightly below the share of 27 % in 2030 that results from the formula contained in Annex II of the Governance Regulation”. (European Commission, 2019d)

The final NECP states that Bulgaria will strive to achieve a share of at least 27.09% of energy from renewable sources in gross final energy consumption by 2030. This is a slight increase over the draft NECP and is in line with the formula contained in the Governance Regulation for determining national contributions to the EU target.

According to the Governance Regulation, interim reference points need to be reached on the way until attaining the 2030 target, to be sure that efforts do not fall short. These interim reference points show what percentage of the total increase of RES in final energy consumption until 2030 needs to be attained by 2022, 2025 and 2027. These are presented in the table below.

Table 3 RES trajectory of the draft and final NECPs and the Governance Regulation reference points, Bulgaria

	2022	2025	2027	2030
<b>Reference points set by the Governance Regulation</b>	18.00%	20.77%	23.21%	27.00%
<b>Progress in the draft NECP</b>	20.00%	21.00%	23.00%	25.00%
<b>Progress in the final NECP</b>	21.54%	23.56%	24.97%	27.09%

The 25% target contained in the first NECP draft would have been achievable with existing measures only, and the new RES target is achievable with little additional effort. If we assess the RES target not from the perspective of compliance with the reference points set out by the Energy Union Governance Regulation, but in terms of cost effectiveness, it is likely that a 27.09% target is far from being on a cost-optimal trajectory towards 2050, considering the 2050 net zero emissions target, which will need to see a decarbonised electricity sector by 2040 across the EU. (European commission, 2018)

Bulgaria overachieved its 16% target for 2020 set out in the Renewable Energy Directive 2009/28/EC, therefore the starting point for achieving the 2030 target is favourable. The availability of a high level of EU funding for 2021-27 for Bulgaria combined with rapidly decreasing RES costs and a good starting point imply that Bulgaria should consider overachieving its 2030 target as well, as a rational way forward.

With respect to RES in the electricity, heating and cooling and transport sectors, the table below compares the targets of the draft and the final NECPs and the EUCO3232.5 scenario of the PRIMES model for 2030 for Bulgaria.

Table 4 RES share in the electricity, space heating and cooling and transport sectors in of the draft and final NECPs and the EUCO3232.5 scenario in 2030, Bulgaria

	Share of RES in 2030 in electricity	Share of RES in 2030 in heating and cooling	Share of RES in 2030 in transport
<b>Draft NECP</b>	17.00%	44.00%	14.00%
<b>Final NECP</b>	30.33 %	42.60 %	14.2 %
<b>EUCO3232.5</b>	48.5%	40.7%	13.3%

The increase in RES share in the final NECP compared with the draft NECP comes from a significant increase in the electricity sector, accompanied with a slight decrease in heating and cooling. However, the share of RES in the final NECP is still significantly lower than that of the EUCO3232.5 scenario, which foresees almost half of all electricity generation coming from RES in 2030, compared with less than a third in the final NECP.

In the electricity sector, Bulgaria plans to increase renewable electricity generation by around 50% by 2030 compared with 2020, an increase from 8.7 TWh to 13.0 TWh. However, by 2030 the EUCO3232.5 scenario foresees a 38% higher cost-effective RES potential in the electricity sector in Bulgaria than the final NECP. The 2030 renewable electricity mix projections of the Bulgarian NECP and the EUCO3232.5 scenario differ quite significantly for wind, where the final NECP foresees only around 2.0 TWh of wind generation in 2030, while according to the EUCO3232.5 scenario, around 7.7 TWh is feasible.

Table 5 RES mix in electricity in 2030 in the draft and final NECPs and the EUCO3232.5 scenario, Bulgaria

Electricity generation from RES (GWh)	final NECP, 2020	final NECP, 2030	EUCO3232.5 scenario
<b>Biomass and biogas</b>	1113	1627	1221
<b>Hydro</b>	4707	4707	4218
<b>Wind</b>	1451	2049	7669
<b>PV</b>	1402	4652	4938
<b>Geothermal</b>	0	0	0
<b>Total</b>	<b>8673</b>	<b>13035</b>	<b>18046</b>

There is little focus on decentralised energy projects, smart grids and storage capacities, as the government of Bulgaria plans to support utility-scale commercial large PV projects rather than projects which are citizen-driven or community-owned. The Belene NPP project, which is expected to come into operation by 2035, could lead to a long-term lock-in and crowd out RES investment in the electricity sector.

The share of RES in heating and cooling is already quite high currently, at 31.07%, due to the high share of biomass. It is foreseen that this share will increase to 42.6% by 2030, with biomass use increasing by 36% over the 10-year period until 2030. The shares of modern renewables in heating and cooling (i.e. solar and heat pumps) remains low.

Table 6 RES mix in space heating in 2030 in the draft and final NECPs, Bulgaria

RES for heating (ktoe)	Draft NECP, 2030	Final NECP, 2030
<b>Bioenergy</b>	1109	1508
<b>Solar</b>	23	30
<b>Ambient heat, geothermal</b>	133	157
<b>Total</b>	<b>1264</b>	<b>1695</b>

The high share of biomass in heating and cooling until 2030 indicates that there is no clear strategy in Bulgaria to modernise the residential heating and cooling sector. This modernization would be desirable due to higher comfort levels offered by more modern RES technologies, as well as biomass sustainability issues, but mostly due to the high levels of air pollution attributable to biomass heating. It is advisable that Bulgaria focuses on modernising the energy parameters of its residential building stock through the use of EU funds by investing in energy efficiency combined with building integrated RES over the next decade, which would enable it to transition away from traditional biomass, rather than increasing its share. Bulgaria could also take advantage of its geothermal potential in some regions and support alternative RES heating sources such as heat pumps, solar collectors and geothermal energy (EU funds could be used for construction of small-scale RES facilities).

## 2.2. Fossil fuels

### 2.2.1. Coal and lignite

The Commission, in its assessment of the first NECP, noted that “the final plan should include an impact assessment of planned policies and measures, including notably the major policy decisions such as the delayed phase-out of lignite beyond 2030” (European Commission, 2019d) and expressed concern over the continuous use of lignite for electricity generation over 60 years (i.e. until reserves are depleted), stating that “the consistency of this objective with the decarbonisation efforts merits further discussion in the final plan”. (European Commission, 2019d) The final NECP itself notes that during stakeholder consultation “parties have questioned Bulgaria’s ability to maintain the operation of its coal-fired power plants [...] while at the same time achieving the EU decarbonisation and renewable energy targets” and that “coal-fired generation of electricity and heat contributes to over 90 % of the GHGs in the sector”. (Ministry of Energy of the Republic of Bulgaria & Ministry of Environment and Water of the Republic of Bulgaria, 2020)

Despite this, the final NECP does not constitute a significant improvement over the draft NECP in this respect and still mentions utilisation of coal for a further 60 years for electricity generation, albeit at a decreasing rate; generation from lignite-fired power plants is projected to decrease by around one quarter over the decade until 2030 and coal in primary energy consumption is expected to decrease from 6420 ktoe in 2020 to 4809 ktoe in 2030.

Coal fired electricity generation in the EUCO3232.5 scenario is around 12.1TWh in 2030 compared with 14.5TWh assumed in the final NECP. Installed capacity will decrease from 4.3GW in 2020 to 2.5GW in 2030 according to the final NECP, however, 1.5GW of lignite capacity is still projected to remain in the system in 2040. The NECP is not clear on the specific coal power plants that will be decommissioned.

Table 7 Lignite in electricity generation in the final NECP and EUCO3232.5 scenario, Bulgaria

	Final NECP, 2020	Final NECP, 2030	EUCO3232.5 scenario
<b>Electricity generated from lignite, GWh</b>	19426	14528	12087

In response to the draft NECP, the Commission requested that Bulgaria integrate just and fair transition aspects better, notably by providing more details on social, employment and skills impacts of planned objectives. However, the final NECP still lacks a detailed description of the impacts on regions affected by closures of power plants, and potentially, of mines. The final NECP mentions that “the national Parliament approved Bulgaria's application to join the Mining Areas in Transition programme [and that] consultations are currently under way that will enable Bulgaria to join other

EU support initiatives for coal regions in transition to a low-carbon economy". (Ministry of Energy of the Republic of Bulgaria & Ministry of Environment and Water of the Republic of Bulgaria, 2020)

Several reports (REKK, TU Wien, CSD, EPG, & FACETS, 2020, Klimapolitika, 2020) have shown that the future of coal and lignite plants does not depend on government decisions to keep them open, as the increasing carbon price and decreasing cost of renewables is making their continued operation uneconomical. Bulgaria will need to consider alternative options a very significant share of its current fleet with low carbon options within the next decade.

### 2.2.2. Natural gas

According to Bulgaria's final NECP, the country has identified several investment priorities related to diversifying sources and routes for the country's natural gas supply. Bulgaria is planning on "building an interconnector between Bulgaria and Greece (IGB project), building an interconnector between Bulgaria and Serbia (IBS project), participating in the construction of a liquefied natural gas (LNG) terminal in Alexandroupoli, and gas infrastructure development in connection with the plan to build a regional gas distribution centre (Balkan Gas Hub)". (Ministry of Energy of the Republic of Bulgaria & Ministry of Environment and Water of the Republic of Bulgaria, 2020) Supply of natural gas would also be increased through the development of domestic sources, including exploration of gas deposits in the Black Sea, and Bulgaria is also planning on expanding the capacity of the Chiren Underground Gas Storage facility. Several of the natural gas investment projects planned in the NECP are expensive megaprojects that increase the external geopolitical dependence of Bulgaria on energy.

Bulgaria plans to increase the use of natural gas in energy transformation and end use sectors. Gas consumption is expected to increase from 2740 ktoe in 2020 to 3391 ktoe in 2030, an increase of around 24%. During the same period, the amount of natural gas imports is projected to increase by around 20%.

The country has a household gasification programme through which it provides support to households to transition from burning traditional fuels to natural gas, and also plans to carry out reconstruction of district heating cogeneration systems and boilers with natural gas turbines. Natural gas also has a role in replacing some of the outgoing coal capacity in the power sector, with the capacity of gas fired power plants projected to increase from 1.9 GW in 2020 to 2.5 GW in 2030, and gas fired electricity generation is set to increase from 1865 GWh in 2020 to 5539 GWh in 2030. The latter will only constitute around 12% of net electricity generation in 2030.

Although not mentioned explicitly, there is a clear intention to rely on natural gas as a bridge fuel towards decarbonisation. The SEERMAP study (Szabó et al., 2017) demonstrated that the role of natural gas in a decarbonisation scenario is limited in Bulgaria's electricity sector, with a continuously decreasing role for natural gas in electricity generation until 2050. This is in clear contrast with the approach of Bulgaria in the final NECP.

## 2.3. RES integration

### 2.3.1 Interconnectivity

Bulgaria has set an electricity system interconnection target of 47.1 % by 2030, which exceeds the EU target of 15%. Interconnectivity must also reach 30% of projected installed capacity for renewable energy generation for 2030 and of maximum peak capacity. Both requirements are significantly exceeded by the planned total transmission capacity of interconnectors at 12 320 MW. A total investment of EUR 1 587 million in grids is foreseen in the next decade.

The list of priority projects indicates that grid development plans centre around the Maritsa Iztok 3 and Kozloduy power plants. The reasoning behind the national objectives regarding increasing the flexibility of the national energy system also relates to nuclear and coal and does not mention renewables. Over the next decade there will be a need to invest in transmission capacity which is not driven by the current outdated fleet of power plants, but by links to potential new RES development (e.g. Black Sea Wind) and to storage facilities inside and outside the country. Some elements are already present in current planning, including the Bulgaria—Romania ‘Black Sea corridor’.

### 2.3.2. System flexibility

Storage projects mentioned specifically in the context of the need to balance supply from intermittent RES with demand include the Yadenitsa hydro-pumped storage project which entails increasing the operational capacity of the Chaira Pumped Storage hydropower plant through the construction of the Yadenitsa reservoir, investment in frequency regulation batteries with a total capacity of 180 MW, and investment in 200MW of new energy sources combined with electricity storage facilities.

The NECP states that the measures required to “ensure a secure and reliable operation of the electricity system in Bulgaria while taking account of the increased number of power plants generating renewable energy, including wind and solar power” (Ministry of Energy of the Republic of Bulgaria & Ministry of Environment and Water of the Republic of Bulgaria, 2020) are included in the relevant development plans of the Electricity System Operator and the operators of distribution networks. However, no further information is provided. An estimated total investment cost of EUR 620 million is foreseen for electricity storage facilities, with all investment taking place in the second half of the 2020’s.

Very little concrete information is contained in the final NECP on smart grids and demand side response (DSR). No targets or investment needs have been identified related to smart grids or DSR. However, a set of policies and measures are discussed briefly which could aid flexibility on the demand side, including dynamic pricing and demand response measures.

### 2.4. Investment needs, financial support and harmful subsidies

The NECP states that “Bulgaria does not provide energy subsidies, including for fossil fuels”. (Ministry of Energy of the Republic of Bulgaria & Ministry of Environment and Water of the Republic of Bulgaria, 2020) However, this does not seem to be the case, based on e.g. subsidies provided to lignite plants to keep them operational given the current high EUA prices (REKK et al., 2020) and Bulgaria’s intent to “use the possibility for transitional free allocation of greenhouse gas emissions allowances to electricity generation during the fourth stage of EU ETS transition period 2021-2030.” (Ministry of Energy of the Republic of Bulgaria & Ministry of Environment and Water of the Republic of Bulgaria, 2020) Development of a capacity mechanism is also underway and there is support provided for household gasification.

Only brief and general descriptions of available funding instruments and their potential uses are contained in the final NECP, without details on specific interventions that will be funded or the approximate financial allocation.

Total planned investment in RES is estimated at around EUR 2.3 bn in the electricity sector until 2030, including 0.3 bn in wind, 1.7 bn in solar PV and 0.4 bn in biomass plants. However, Bulgaria also plans to invest around EUR 610 million in lignite and natural gas plants until 2030.

### 3. Greece

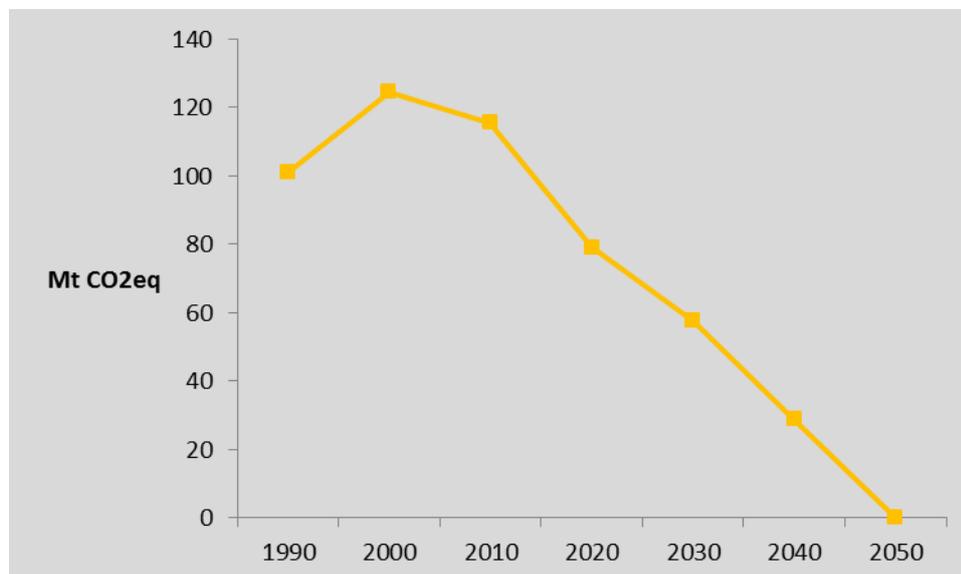
This chapter is based on the draft National Energy and Climate Plan of the Hellenic Republic (Ministry of Environment and Energy of the Hellenic Republic, 2019), on the final National Energy and Climate Plan of the Hellenic Republic (Ministry of the Environment and Energy of Hellenic Republic, 2019), on the European Commission's recommendations on the draft National Energy and Climate Plan of Greece (European Commission, 2019b) and the related factsheet (European Commission, 2019e) and Commission staff working document (European Commission, 2019a), on the analysis carried out by Facets on the revised Greek NECP and the Greek LTS (Facets, 2020) and on Agora Energiewende's report on the draft NECPs of the EU Member States of South-East Europe (Agora Energiewende, 2019).

#### 3.1. Decarbonisation

##### 3.1.1. GHG emissions

The draft NECP included the binding national target of reducing non-ETS greenhouse gas emissions by 16 % by 2030 compared to 2005. The draft already signalled that the country would probably overachieve this target by 13% in the WAM scenario (with additional measures). The final NECP more than doubled the ambition: the new target for non-ETS GHG reduction is 35.4%, which is not surprising if we consider that the total phase out of lignite decided by Greece will also affect individual heating systems. With these targets, Greece is on a pathway to achieving net zero emissions by 2050, as shown in Figure 2 below.

Figure 2 1 GHG emission trajectory (incl. LULUCF) of Bulgaria towards a net zero target in 2050\*



*\*only 10-year intervals are shown and linear trajectory is assumed between these points*

The Commission pointed out that in the draft NECP there were no estimates of the annual binding national limits for 2021-2030 under the Effort Sharing Regulation. In the final NECP interim numbers are presented for 2022, 2025 and 2027 both for non-ETS emissions in Mt CO<sub>2</sub>eq and for emission reductions in the non-ETS sector as a percentage of 2005 emissions. These are important information, but just estimates, not binding annual targets.

The Commission also recommended to have separate GHG emission reduction targets for buildings and for the transport sector. These targets are missing also from the final NECP.

Although there is no recommendation by the Commission on the draft NECP concerning the reduction of greenhouse gas emissions, with the phasing out of lignite, GHG objectives became much more ambitious. The draft NECP contains a calculation on what the overall reduction target of the country would be considering policies and measures affecting both the ETS and the non-ETS sectors. The calculation shows that a reduction of 33% compared to emissions in 1990 and 49% compared to emissions in 2005 would be reached by 2030. The final NECP also contains the calculations on what the policies and measures and the non-ETS sector target imply at the Member State level: GHG reduction of more than 41% compared to 1990 and more than 55% compared to 2005.

### 3.1.2. Energy efficiency

Concerning energy efficiency, the level of ambition for both primary and final energy consumption targets for 2030 has been increased in the final NECP of Greece. Primary energy consumption (PEC) went from 25 Mtoe to 22 Mtoe, final energy consumption (FEC) decreased from 18 Mtoe to 16.5 Mtoe. This means that final energy consumption will improve by 38% instead of the initially planned 32%, meaning also that the objective set by Greece is higher than the common EU energy efficiency objective of 32.5% improvement in FEC. The lack of ambition in energy efficiency goals was one of the main criticisms formulated by the Commission. With this rise in the level of ambition, we could think that this criticism no longer stands. But if we consider the PRIMES model's EUCO3232.5 scenario, we see that the recommended target for Greece is 17.4 Mtoe PEC and 14 Mtoe FEC for 2030, which is still much lower than what Greece intends to reach.

Another criticism of the Commission was that Greece did not show in the draft NECP any decoupling of economic growth and domestic final energy consumption. With the rise in energy efficiency, there is hope that decoupling will happen.

The promotion of energy efficiency takes different forms in the NECP. Both in the draft and in the final plan emission reductions in the building sector are deemed important. Both versions contain the same measure (required under EU legislation) for central government buildings: 3 % of the total surface area of the heated parts of these buildings have to be renovated annually, or in other words, 5400 m<sup>2</sup> per year. A new financial mechanism to support this measure – ELEKTRA – has been added to the final plan. Residential buildings are also planned to be renovated or replaced. The final NECP shows more ambitious targets in this sector: new nearly zero-energy buildings will amount to 12-15% of all residential buildings by 2030 compared to the 10% estimated in the draft NECP. In the final plan, the objective is to renovate or replace 60 000 residential dwellings every year compared to the 40 000 per year target of the draft NECP. The Commission missed quantitative targets related to the entire building stock, this element is also missing in the final NECP.

The draft NECP already stated that the transport sector is expected to become the main source of emissions after 2030. According to the final NECP, the increase of energy efficiency in the transport sector is planned to be reached by developing a framework for the replacement of polluting passenger and goods vehicles as well as by developing infrastructure and plans for a modal shift in the sector, insuring the possibility to opt for the use of alternative fuels. Promoting electromobility is one of the strategic policy priorities according to the final NECP. The use of electric vehicles and more efficient internal combustion vehicles in passenger transport will lead to a 11% decline in FEC by 2030 compared to 2020 in spite a more than 15% increase in pkm. This number was lower in the draft NECP, a 9% decrease in FEC was planned for 2030 compared to 2016, mostly due to a much larger (24%) increase in pkm in 2030 compared to 2016. A shift to electricity in passenger road transport has significant results in energy efficiency: unit consumption is expected to be 31.8 ktoe/kpkm in 2020 but only 24.6 ktoe/kpkm in 2030. Although reducing the demand for road

transport should also be an important part of the plan, there is no concrete mention of this topic in the final NECP.

Both for the building sector and the transport sector, smart metering is a central element of the system aiming at increasing energy efficiency.

### 3.1.3. Renewable energy

Concerning renewable energy, the Commission did not ask Greece to raise its level of ambition, nonetheless, Greece increased its target from 31% in the draft NECP to 35% in the final NECP. This is higher than the common EU goal of 32% of renewable energy in final energy consumption.

The Commission recommended that Greece should concentrate on having a good timing and a cost-effective method for reaching its RES target. Considering that in the final plan, Greece intends to reach a 61% share of renewable energy in the electricity sector by 2030, we can declare that the country will be most probably on the right trajectory to be climate-neutral by 2050. This also means that increasing the share of RES will be expectedly carried out in a cost-effective way, as the bulk of the work is not left to the end of the period. If Greece can get to 61% by 2030, it can most probably get to 100% share of RES in electricity generation in twenty years, by 2050.

The Commission not mentioning the possibility of increasing the target is surprising if we consider that the PRIMES model's EUCO3232.5 scenario concludes that Greece could reach a 39.3% share of RES in FEC by 2030.

According to Article 4 of the Governance Regulation, interim reference points need to be reached on the way until attaining the 2030 target, to be sure that efforts do not fall short. These interim reference points show what percentage of the total increase of RES in gross final energy consumption until 2030 needs to be attained by 2022, 2025 and 2027.

Table 8 Planned progress in achieving the 2030 RES target (% in Gross Final Energy Consumption)

	2022	2025	2027	2030
Progress in the draft NECP	19.9%	22.9%	26.2%	31%
Progress in the final NECP	23%	27%	29.6%	35%

In the draft plan none of the reference points were at the right level as set by the Governance Regulation, whereas in the final plan all reference points reach the required levels.

If we go down to sectoral level, we can see that the level of ambition rose in both the electricity, the heating and cooling and the transport sector.

Table 3 below shows how the targets of the draft and the final NECPs relate to each other but also the targets that the EUCO3232.5 scenario of the PRIMES model suggests as necessary and reachable for Greece.

Table 9 Sectoral RES targets according to the NECPs and the PRIMES EUCO3232.5 scenario

	Draft NECP	Final NECP	EUCO3232.5
Share of RES in 2030 in	55%	61%	75%

electricity			
Share of RES in 2030 in heating and cooling	30%	42.5%	50.3%
Share of RES in 2030 in transport	14%	19%	14.2%

Concerning the mix of renewable energies, we can see that there is no significant change in the proportion of the different RES sources between the draft and the final NECP, whether for electricity generation or for heating. The RES target for transport is not very ambitious, but we have to keep in mind that in this sector – and also in the heating and cooling sector – the increasing use of RES can and will be supplemented by electrification. In the end, indirectly, this also means – as the share of RES in electricity generation gets higher and higher – a higher share of RES in transport.

In the electricity sector, the total power generation from RES increases from 34.8 TWh in the draft to 38.1 TWh in the final NECP. The EUCO 3232.5 scenario of the PRIMES model foresees an even bigger increase: to reach the core energy efficiency and renewable energy targets of the EU, Greece should reach 40.4 TWh of electricity generation from RES by 2030.

In the next table the development of the share of various RES between the two versions of the NECP and also the picture presented by the EUCO3232.5 scenario is presented:

Table 10 Electricity generation from RES according to the NECPs and the PRIMES EUCO3232.5 scenario

Electricity generation from RES (TWh)	2020 in the final NECP	2030 in the draft NECP	2030 in the final NECP	2030 in the EUCO 3232.5 scenario	% of total in 2030 (draft NECP)	% of total in 2030 (final NECP)	2030 target of the final NECP compared to the 2030 target of the draft NECP
Biomass and biogas	0.4	1.7	1.6	0.9	4.9%	4.2%	-6%
Hydro	5.5	6.3	6.6	5.6	18.1%	17.32%	+5%
Wind	7.3	15.5	17.2	19.9	44.6%	45.14%	+11%
Solar*	4.5	10.6	12.1	14	30.5%	31.76%	+15%
Geothermal	0.0	0.6	0.6	0	1.72%	1.58%	0%
<b>Total</b>	<b>17.7</b>	<b>34.8</b>	<b>38.1</b>	<b>40.4</b>	<b>100%</b>	<b>100%</b>	<b>+10%</b>

\* Solar is the addition of the lines 'PV' and 'solar thermal' in the NECPs

There is not much change in the 2030 share of the various RES types from the total RES electricity generation between the two NECPs.

We can see growth in absolute terms for every RES except for biomass and biogas, the biggest growth being in solar (mostly PV) and wind.

The fact that the increase in electricity generation from biomass between 2020 and 2030 went from sixfold in the draft NECP to fourfold in the final NECP is a step in the direction of more cautious expansion of the use of biomass but it is still a very steep development of this renewable energy source that is questionable from the angle of sustainability.

If we compare the draft and the final NECPs and we examine the mix of renewable energy sources used for heating, the following picture appears to us:

Table 11 RES used for heating, according to the draft and the final NECPs

RES for heating (ktoe)	2020 in the final NECP	2030 in the draft NECP	2030 in the final NECP	% of total in 2030 (draft NECP)	% of total in 2030 (final NECP)	2030 target of the final NECP compared to the 2030 target of the draft NECP
Bioenergy	1035	1129	1142	52.08%	46.42%	+1%
Solar	296	276	411	12.73%	16.71%	+49%
Ambient heat, geothermal	431	764	906	35.24%	36.83%	+19%
<b>Total</b>	<b>1761</b>	<b>2168</b>	<b>2460</b>	<b>100%</b>	<b>100%</b>	<b>+14%</b>

The contribution of all RES types in meeting space heating needs in final consumption increased from the draft to the final NECP, with solar energy increasing the most in relative terms.

The planned expansion and share of biomass for heating is still very important. Thus, the final NECP can still be accused of “masked” achievement of renewable energy targets. Further expansion of biomass in the heating sector should be limited, as this raises issues of sustainable forest management and local atmospheric quality deterioration.

## 3.2. Fossil fuels

### 3.2.1. Coal and lignite

The share of lignite in the energy mix is the biggest change between the draft and the final NECPs of Greece. Although there has been no direct remark made by the Commission on actual or planned lignite fired power plants, the country made the courageous and wise decision to totally phase out lignite.

All lignite plants in operation in 2020 will be decommissioned by 2023. Only one lignite plant will be operational after 2023: Ptolemais V is under construction, is expected to go online in 2022, but it will stop using lignite in 2028. This means that a total coal phase-out will be carried out by 2028.

Probably the biggest challenge related to lignite phase-out will be the thorough planning of the post-lignite transition, in regions most reliant on the sector, thus the most vulnerable. The Commission’s remark on the planning of a just and fair transition in the draft NECP was that these aspects should be better integrated in general. This was a remark made for a plan that would just decrease the country’s reliance on lignite; a total phase-out of lignite asks for even more robust and timely planning.

The final NECP responded to that demand: an integrated and detailed plan (Just Development Transition Master Plan) is supposed to be presented in mid-2020; this would serve as a roadmap for the post-lignite era. According to the final NECP “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.”

The final NECP states that the Greek government asks for increased funding from the EU, especially for the Just Transition Fund. This is not surprising as such an important change was made to the Greek NECP. The actual situation with the effects of the coronavirus pandemic made the difficult budgetary talks even harder, but considering that the Commission suggested in its new proposal to raise the sum available under the Just Transition Fund from EUR 7.5 billion to EUR 40 billion, Greece can hope for more funding.

### 3.2.2. Natural gas

The main trend that we can see in the draft NECP concerning natural gas is that Greece intends to expand the share of this fuel in final energy consumption. The final NECP states that the country should aim at producing natural gas from its own deposits, either for its own consumption or for export purposes.

When we compare the two NECPs by examining the use of gas in the sector of industry, we see the same, increasing trend in both plans, although the magnitude of the development is more modest in the final NECP if we take absolute numbers.

Table 12 Share of natural gas in the final energy consumption of industry

	Draft NECP 2020	Final NECP 2020	Draft NECP 2030	Final NECP 2030	Growth 2020-2030 draft NECP	Growth 2020-2030 final NECP	Share of total in 2030 draft NECP	Share of total in 2030 final NECP
Final energy consumption in the sector of industry (ktoe)	3391	3011	3447	2879	+1.65%	-4.38%	-	-
Natural gas consumption (ktoe)	712	620	928	770	+30.34%	+24.19%	26.92%	26.75%

In the draft NECP, final energy consumption in the industrial sector was planned to increase by 1.65% and the consumption of natural gas by 30.34%. Although in the final NECP, the consumption of natural gas rises only by 24.19% from 2020 to 2030, we have to keep in mind that the final energy consumption of the sector decreases by 4.38%. This means that Greece still plans an important development of the share of natural gas in industry and that this share is basically planned to be the same by 2030, no matter if we examine the draft NECP (26.92% of industry FEC) or the final NECP (26.75% of industry FEC).

According to the latest information of the Greek TSO concerning December 2019 (The Independent Electricity Transmission Manager, 2019), in 2019 electricity from natural gas accounted for 28% of the electricity generation (16 228 GWh out of a total of 57 685GWh of which 52 575 GWh in the mainland grid). This is up from 24% in 2018 (26% according to the International Energy Agency (International Energy Agency, 2018)). What is clear from the final NECP is that Greece intends to increase the role of natural gas, as the electricity generation from natural gas inscribed in the final NECP in 2030 reaches 32% and calls for an increase of natural gas capacity of 25% by 2030.

Natural gas is often considered a good replacement for coal or lignite, as its specific CO<sub>2</sub> emission is lower than that of the above-mentioned fossil fuels. Although this is true, investing in such substantial development of natural gas in a country having huge opportunities for renewable energy carries the risk of leading to stranded assets.

Both the draft and the final NECPs contain the same projects supporting the development of gas interconnections. The NECPs list the projects in the Natural Gas Market Roadmap. The following gas interconnection projects are meant to be implemented until 2030:

- completion of the Trans Adriatic Pipeline;
- implementation of the gas interconnector between Bulgaria and Greece;
- planning of the Turkey-Greece-Italy interconnector;
- planning of the East Med pipeline
- push for the interconnection of Greece and North Macedonia

There is still no timetable for these projects in the final NECP.

Concerning regional-international cooperation connected to gas supply, the final NECP contains a more detailed presentation, not just a list of countries with whom Greece launched international cooperation.

For the security of energy supply, Greece participates in different risk groups:

- the Ukraine Eastern gas supply risk group, that is made of Bulgaria, Czech Republic, Germany, Greece, Croatia, Italy, Luxembourg, Hungary, Austria, Poland, Romania, Slovenia and Slovakia;
- the Trans-Balkan Eastern gas supply risk group in which Greece stands with Romania and Bulgaria;
- the Algeria North-African gas supply risk group, along with Spain, France, Croatia, Italy, Malta, Austria, Portugal, Slovenia;
- and the South-East gas supply risk group, which is currently inactive.

### 3.3. RES integration

#### 3.3.1. Interconnectivity

Development of regional interconnectivity is crucial to ensure energy security in the future. Both in the final and in the draft NECPs, the interconnectivity target of Greece is to reach 15% by 2030.

The Commission did not make remarks on the level itself; recommendations were related to the details of policies and measures and the connected timing for their implementation.

Furthermore, the country's special situation induced by the presence of many islands asks for special responses: the national transmission infrastructure has to be developed to better connect the Greek islands to the mainland.

The final NECP contains strategic policy priorities and one of them is speeding up the electrical interconnection of the islands; another one is strengthening of energy interconnections.

Concerning the 29 autonomous island electrical systems, and the plan on their connection to the main system where possible, the final NECP gives some more information: the objective of the country is to connect all these island electricity systems to the interconnected electricity system by 2029, where it can be carried out in a cost-efficient way, such as the undersea cable to connect Crete to the mainland to accommodate 2.5 GW of wind and solar power. Where this is not possible, the objective is to upgrade the remote island electricity systems with innovative energy applications, making them “smart” islands. The implementation of this plan will not only make possible the switch to fuels less harmful for the environment (actually, electricity generation is mainly based on diesel-fired power plants) but will also result in financial savings at the national level and in the decrease of energy dependency.

The strengthening of electricity interconnections with neighbouring countries is one of the pillars of energy security, and it is a strategic policy priority of Greece’s NECP. The electricity interconnection projects that are planned to be implemented until 2030 are the same in the two NECPs:

- the second interconnection between Greece and Bulgaria (expected for 2023 in the final NECP);
- further development of the Greece-Cyprus-Israel interconnection project;
- upgrading of the interconnection between Greece and the Republic of North Macedonia.

The improvement of the Greece-Albania interconnection of 150 kV was listed in the draft NECP but is not contained in the final NECP, although Albania is listed as a country with which regional cooperation has already been started for electricity interconnections.

In the final NECP, a timetable has been provided that contains the projected implementation year of domestic interconnection projects and timing for the Greece-Bulgaria interconnection. We can therefore say that Greece took into consideration the Commission’s recommendations on giving details on timing in the final NECP.

### 3.3.2. System flexibility

In the final NECP, developing strategic storage projects is listed amongst the strategic policy priorities for Greece in the period until 2030. Developing an appropriate legislative and institutional framework for storage projects – both centralised and decentralised is also crucial according to the document. This framework has to make possible the quick and relatively simple installation of storage units within RES plants, as this would help attaining the high share of RES planned in electricity generation. Even making the installation of electricity storage systems compulsory when building a new RES plant is amongst the plans. The increase of storage capacity in the interconnected system is expected to reduce energy costs and increasing flexibility.

In Greece, electricity storage is also important in the islands that are not planned to be interconnected with the main electricity system. These islands, albeit very small, with electricity demand totalling less than 10GWh annually (Hellenic Electricity Distribution Network Operator, 2019) are actually getting power from diesel plants, but the objective is to gradually switch to renewable energies. This can be carried out only with development of storage facilities on the islands. According to the final NECP “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". The Ikaria plant has been constructed with pumped storage, the one on Tilos with battery storage.

One of the policy measures foreseen by Greece for climate change and GHG emissions reductions and removals is connected to storage and is appearing only in the final NECP: "promoting RES, storage systems and fuel production from RES". A policy measure for a "regulatory and statutory framework for storage facilities" appears amongst measures planned for RES promotion. Storage projects appear also in the list of measures for strengthening energy security. Electricity storage system development – similar to the Amphiloikia pumped storage project – appears in the list of main projects related to the electricity network.

In its final NECP, Greece plans to develop various types of storage technologies, from pumped storage via batteries to conversion into gas and storage with the increase of electromobility.

Demand side management is just as important as the development of renewable energies, storage, or energy efficiency. Demand side response adds to the flexibility of the electricity system and goes hand in hand with the development of electricity storage capacity. Both NECPs point out that demand response will increase adequate system capacity and decrease the costs of electricity and also energy dependency. They also underline that for demand side response to work, several elements have to be developed: completion of the electricity market reform, implementation of financial instruments that motivate the final consumers who are targeted by these measures, and the development of monitoring, with smart meters that will be key to the proper functioning of the new electricity system.

One of the planned measures in both NECPs for strengthening energy security is "arrangements for promoting electricity demand response". Amongst energy efficiency measures, "development of the regulatory framework for demand response" appears also in both plans. The internal energy market will be developed via "adoption of measures for strengthening demand response and for the participation of demand in the wholesale electricity market", amongst others.

With the development of the electricity market, consumers' role is becoming much more important. They become electricity producers, and, with demand response, they can also add to the flexibility of the system. Instituting aggregators and giving the possibility for consumers to participate in energy communities is a sine qua non condition of the demand response system to work, and Greece has already started to transform the legislative framework towards that direction.

### 3.4. Investment needs, financial support and harmful subsidies

Investment needs connected to the NECP are presented in the same structure in both versions of the plan, which makes comparison quite comfortable.

The draft NECP estimates that approximately EUR 34.7 billion will be needed to implement the plan between 2021 and 2030. Implementing policies and measures of the final NECP will necessitate EUR 9 billion more, as the total bill will amount to around EUR 43.8 billion.

The biggest differences lie:

- in the sum reserved for energy efficiency: in the final plan, the country plans to spend EUR 2 billion more on this area, EUR 11 billion in total.
- in the elimination of EUR 1.9 billion funding for new conventional electricity generation plants and for upgrading of existing conventional plants.
- in the EUR 2 billion funding for climate change, flood management and forests, as a new element of the financing plan

- in the EUR 5 billion funding for circular economy, also appearing as a new element in the financial plan of the final NECP.

Table 13 Estimation of investments in the key areas of the draft NECP and the final NECP

<b>SECTOR</b>	Total estimated investments (€ million) for the period 2020-2030 <b>Draft NECP</b>	Total estimated investments (€ million) for the period 2020-2031 <b>Final NECP</b>	<b>Difference</b> between draft NECP and final NECP
Electricity generation from RES	8500	9000	500
Electrical system infrastructure	5500	5500	0
New conventional electricity generation plants and upgrading of existing	1900	0	-1900
New thermal electricity generation plants and central storage plants	0	1300	1300
Works for the development of an electricity distribution network – Digitisation	3300	3500	200
Cross-border natural gas pipelines	2200	2200	0
Natural gas networks and storage	2000	2000	0
Research and Innovation	800	800	0
Energy efficiency	9000	11000	2000
Investments in the Refinery sector	1500	1500	0
Climate change, flood management, forests	0	2000	2000
Circular economy, recycling	0	5000	5000
<b>TOTAL</b>	<b>34700</b>	<b>43800</b>	<b>9100</b>

Concerning financing, the Commission recommended that details on investment needs and funding sources should be added to the final plan. One of the reasons for this was that it was not clear how the ageing lignite-fired power plants would be financed to be capable of staying in the system. As Greece opted for a total phase-out of lignite, this part of the question no longer stands. Details on financing of the plan have been added to the document this brought more clarity to the final NECP.

As mentioned earlier, the final NECP contains a non-exhaustive list of strategic policy priorities. One of them is to develop new financial instruments.

The presentation of funding options is enhanced: besides the ERDF – that was also presented in the draft NECP – the Cohesion Fund is also presented as a source of funding. The NECP estimates that Greece will get minimum EUR 3066.6 million from the ERDF and around EUR 1789 million from the Cohesion Fund (at constant 2018 prices) are estimated to be available under Policy Objective 2 of the

draft Common Provisions Regulation. Taking into account national funds, the total reaches approximately EUR 7161.2 million at constant 2018 prices. These will most probably change in the light of the new budget presented after the outbreak of the Covid pandemic.

Although there are no numbers presented, other funding options are also in the final plan: the national resources of the Public Investment Programme, or the EU-financed Rural Policy Programme, the Asylum, Migration and Integration Fund, the Internal Security Fund - Borders and Visa and the Invest EU programme (sustainable infrastructure policy area).

Concerning financing, another important point of the Commission's recommendations was the topic of harmful subsidies. The Commission recommended to make a list of all energy subsidies, including subsidies for fossil fuels, and also to present past and future actions for phasing them out.

In the final NECP, the chapter on internal energy market has been supplemented with a subchapter on fossil fuel subsidies, which is clearly a step towards answering the Commission's recommendations, although there is only a vague allusion to Greece making progress in reforming its subsidies for fossil fuels.

Greece underlines in its final NECP that social policy measures translating as fossil fuel subsidies are and will be in the system; however, the country is trying to reform these. These social measures are aimed at fighting energy poverty, for example the Social Domestic Tariff or the allowance scheme for the purchase of heating oil. The NECP also stresses that high energy prices lead to the burning of waste in some regions, which causes tremendous air pollution problems. This also has to be kept in mind when reforming the social energy policy measures.

One of the measures that Greece is planning to implement to manage the question of energy poverty and social subsidies is the renovation of buildings resulting in lower bills because of lower energy consumption; another is the promotion of self-generation programmes (prosumers).

The final plan states that in the electricity sector, these social subsidies are getting less and less relevant from a harmful subsidies point of view, as the share of renewable energy in the country's electricity mix is getting higher and that they "will no longer constitute an indirect subsidy to fossil fuels in the short to medium term". This declaration seems to be somewhat exaggerated as Greece is using natural gas in its electricity mix and is also planning to develop its gas infrastructure, meaning that fossil fuels will stay in the system.

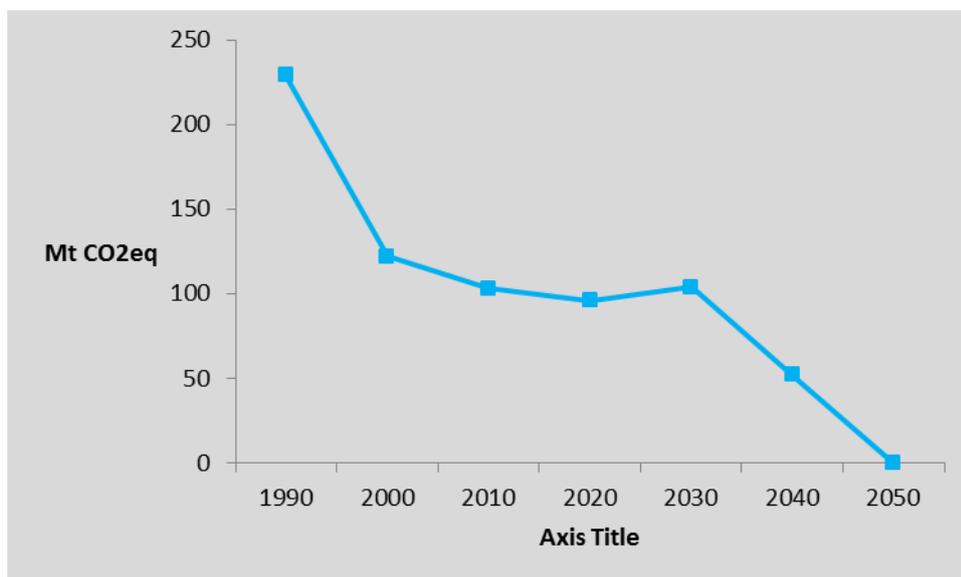
## 4. Romania

### 4.1. Decarbonisation

#### 4.1.1. GHG emissions

Romania has set a GHG emission reduction target for the non-ETS sector at -2% by 2030 compared with 2005 and estimates that ETS sector emissions will be reduced by 43.9% by 2030 % compared to the same base year. Total national emissions of greenhouse gases will be equal to 118.35 mtCO<sub>2</sub>eq by 2030, excluding LULUCF. This is equivalent to an approximately 50% reduction in emissions compared with 1990. The final NECP also states that “GHG emissions are likely to be further reduced, according to the WAM scenario updated following the Commission’s recommendations, after the strategic documents prepared by the government institutions in Romania have been completed.” (Government of Romania, 2020) The target for the non-ETS sector is in line with that set out in the Effort Sharing Regulation.

Figure 3 GHG emission trajectory (incl. LULUCF) in MtCO<sub>2</sub>eq of Romania towards a net zero target in 2050\*



*\*Only 10-year intervals are shown and linear trajectory is assumed between these points. No information on projections incl. LULUCF is available in the NECP, therefore LULUCF contribution was assumed constant from 2017 onwards.*

Although the non-ETS sector target complies with that set out in the Effort Sharing Regulation, the emission reduction trajectory planned until 2050 is likely not cost-optimal. As can be seen in Figure 3, Romania’s current level of emission reductions were achieved as a result of the economic collapse following the economic transformation in the 1990s, and emission reduction has slowed down significantly since then. A slight increase in emissions is expected by 2030 compared with current levels, followed by a steep downward trajectory which ensures achievement of a net zero target. The final NECP delays the effort to reduce emissions until after 2030, burdening the future with a very high emission reduction rate while doing very little in the next decade.

Romania should seize opportunities offered by decreasing renewable costs and the availability of EU funding for investing in the low carbon economy and bring forward some of the emission reduction efforts which are currently planned for after 2030.

#### 4.1.2. Energy efficiency

Romania plans to decrease its primary energy consumption by 45.1% and its final energy consumption by 40.4% compared to the PRIMES 2007 reference scenario by 2030. In absolute terms, this constitutes only a 0.2 Mtoe decrease in primary energy consumption in 2030 compared with 2020, from 32.3 to 32.1 Mtoe over a decade. The target for reducing energy consumption is only slightly more ambitious than contained in the previous draft of the NECP. (Government of Romania, 2019)

Table 14 Primary and final energy consumption targets in the final NECP and the EUCO3232.5 scenario, Romania (Mtoe)

	Final NECP, 2020	Final NECP, 2030	EUCO3232.5 scenario, 2030
<b>Primary energy consumption</b>	32.3	32.3	29.3
<b>Final energy consumption</b>	23.5*	25.7	22.2

\*value for year 2018

While energy used for space heating and cooling will be reduced by around 5% by 2030 compared with 2020, energy consumption of the transport sector is expected to increase by close to 10% over the next decade. Although the relatively low effort made in the non-ETS sector is justifiable due to a low starting point characterised by lower car ownership and energy poverty resulting in underheating, Romania should more actively try to identify cost-effective solutions to reducing energy demand to ensure that the bulk of the effort is not left until after 2030.

Table 15 Projected Final energy consumption in households, services and transport according to the final NECP (ktoe), Romania

	2020	2025	2030
<b>Heating and cooling</b>	14100	14044	13383
<b>Transport</b>	6324	7194	6949

Buildings constitute an important part of the effort to reduce emissions. Multifamily buildings in the residential sector will be renovated to class A, while single family housing will be renovated to class B. The annual renovation rate will increase from 0.69% in 2020 to 3.39% by 2030 and to 4.33% by 2050. Although such an effort enables the renovation of the entire building stock by 2050, which is positive, much of the effort is left until later on, with a low initial renovation rate in 2020.

According to plans, a total of EUR 12.8 bn will be invested in renovating residential and commercial buildings over the next decade. It is planned that only EUR 1.8 bn will be provided by the owners of the buildings up front, while the rest will come from reimbursable and non-reimbursable support from the government. Renovation will lead to final energy consumption of 3.38 Mtoe in buildings in 2050, a 66 % reduction compared to the baseline scenario and a 65% reduction compared with 2017 (IEA, n.d. and Government of Romania, 2020).

#### 4.1.3. Renewable energy

Romania set the target for its share of renewable energy in gross final energy consumption at 30.7% for 2030, which is in line with the formula contained in Annex II of the Governance Regulation. The target constitutes a small increase from the value set in the draft NECP, at 27.9%.

According to the Governance Regulation, interim reference points need to be reached on the way to attaining the 2030 target, to be sure that efforts do not fall short. These interim reference points show what percentage of the total increase of RES in final energy consumption until 2030 needs to be attained by 2022, 2025 and 2027. These are presented in the table below.

Table 16 RES trajectory of the draft and final NECPs and the Governance Regulation reference points, Romania

	2022	2025	2027	2030
<b>Reference points set by the Governance Regulation</b>	25.2%	26.9%	28.4%	30.7%
<b>Progress in the draft NECP</b>	27.0%	28.1%	28.0%	27.9%
<b>Progress in the final NECP</b>	25.7%	27.4%	29.3%	30.7%

The achievement of the target for RES will involve increasing the share of renewable electricity from 41.0% in 2020 to 49.4% in 2030, while the share of RES in heating and cooling is projected to increase from 25.2% in 2020 to 33.0% in 2030. More than half of the 26417 ktoe required to meet the RES target for 2030 will be met from heating and cooling (13383 ktoe), with electricity generation (6428 ktoe) and transport (6949 ktoe) contributing close to equally in absolute terms.

The overall RES share has increased in the final NECP compared with the draft NECP, mainly due to an approximately 10% increase in RES in the electricity sector. Ambition in the heating and cooling sector has increased only marginally, while the RES share in transport is lower in the final NECP than in the draft, as shown in Table 17.

The target RES shares for the electricity and transport sectors fall below the shares projected by the EUCO3232.5 scenario, under which Romania would be covering around two thirds of its electricity consumption from renewable sources by 2030, compared with around half in the final NECP. In the EUCO3232.5 scenario only around 12% of total electricity generation would come from fossil fuels, with nuclear making up the rest.

Table 17 RES share in the electricity, space heating and cooling and transport sectors in of the draft and final NECPs and the EUCO3232.5 scenario in 2030, Romania

	Draft NECP	Final NECP	EUCO3232.5 scenario
<b>Share of RES in electricity</b>	39.6%	49.4%	66.1%
<b>Share of RES in heating and cooling</b>	31.3%	33.0%	33.3%
<b>Share of RES in transport</b>	17.6%	14.2%	17.8%

The final NECP foresees only a small increase in hydro compared with 2020 levels, while wind generated electricity doubles and solar more than triples its contribution over a decade. The EUCO3232.5 scenario is more optimistic with respect to wind development than the NECP, projecting almost twice as high generation in 2030, but is less optimistic in relation to solar. The final NECP represents a shift away from hydro towards wind and solar, as the draft NECP projected a higher share of hydro and lower shares of wind and solar than the final version. This is a positive development.

Table 18 Electricity generation from RES in the NECPs and EUCO3232.5 scenario (GWh), Romania

	Final NECP, 2020	Draft NECP, 2030	Final NECP, 2030	EUCO 3232.5 scenario, 2030
<b>Hydro</b>	16467	17532	16983	16780
<b>Wind</b>	6566	11002	11687	20222
<b>Solar*</b>	1982	5003	7357	3487
<b>Other</b>	900	900	900	2029
<b>Total</b>	<b>25916</b>	<b>34438</b>	<b>36928</b>	<b>42518</b>

The NECP projects an increase in the use of biomass for heating; the use of this fuel is already high currently, and the NECP indicates a further move towards the use of biomass. A combination of more modern renewables (e.g. solar and heat pumps) with ambitious energy efficiency measures should

be considered. As can be seen from Table 19, in absolute terms the level of ambition has decreased from the draft to the final NECP.

Table 19 RES mix in space heating in 2030 in the draft and final NECPs, Romania

RES for heating (ktoe)	Final NECP, 2020	Draft NECP, 2030	Final NECP, 2030
Bioenergy	3481.2	4216.2	4026.5
Solar	n.a.	n.a.	n.a.
Ambient heat, geothermal	76.2	417.6	383.3
<b>Total</b>	<b>3557.4</b>	<b>4679.7</b>	<b>4409.8</b>

The high share of biomass in heating and cooling until 2030 indicates that there is no clear strategy in Romania to modernise the residential heating and cooling sector. This is desirable due to higher comfort levels offered by more modern RES technologies, as well as biomass sustainability issues, but mostly due to the high levels of air pollution attributable to biomass heating. It is advisable that Romania focuses on modernising the energy parameters of its residential building stock through the use of EU funds by investing in energy efficiency combined with building integrated RES over the next decade, which would enable it to transition away from traditional biomass, rather than increasing its share. EU funding is available to support these investments.

## 4.2. Fossil fuels

### 4.2.1. Coal and lignite

Coal and lignite capacity in the electricity sector is set to decrease from 3240 MW in 2020 to 1980 MW in 2030, a decrease of almost 40%. At the same time, natural gas generation capacity will also decrease slightly, while nuclear and renewables capacity will increase. The NECP does not contain information on generation shares of different fuels in the electricity sector, so it is not possible to assess the role of lignite in generation, i.e. whether it is expected to play a significant role in providing base load electricity, or if it will be kept primarily as reserve capacity.

In the electricity sector additional new nuclear capacity of 675 MW is planned by 2030, raising capacity from the current level of 1300 MW to 1975 MW by 2030. Romania has recently decided to cancel the deal made with Chinese investors to build Cernavoda 3 and 4 and the country is looking for new investors. (BalkanInsight, 2020) It is therefore highly doubtful that Romania will be able to install the new nuclear reactor block 3 at the Cernavoda plant by 2030. The NECP was approved prior to this decision and does not address the issue of how this generation will be replaced, and whether the intention is to keep some coal power plants running for longer, or to substitute for this nuclear capacity with natural gas, renewables, or imported electricity.

The implementation of a capacity mechanism is foreseen by the final NECP which provides support “for additional production capacities alongside the active capacities on the electricity market”. (Government of Romania, 2020) The NECP does not state explicitly that the capacity mechanism is foreseen for coal power plants, but this is what the reference to non-active plants seems to suggest. In any case, coal and lignite are non-compliant with the emission limits required for power plants to participate in a capacity remuneration mechanism, and can only participate as strategic reserves with very limited operation (ACER, 2019) Romania has not yet submitted its plan for a capacity mechanism to the European Commission for approval. (European Commission DG Energy, 2020)

Overall, many uncertainties surround the planned role of lignite in the electricity sector – without information on the precise role of lignite (i.e. as baseload generation or as a reserve), and with the uncertainty surrounding alternatives to the nuclear capacity expansion which is unlikely to come

online as planned, the level of ambition of the NECP in phasing out lignite and hard coal is not possible to assess.

Several reports (REKK et al., 2020, Klimapolitika, 2020) have shown that the future of coal and lignite plants does not depend on government decisions to keep them open, as the increasing carbon price and decreasing cost of renewables is making their continued operation uneconomical and they will be forced to close. Romania will need to consider alternative low carbon options within the next decade.

With respect to the just transition, the final NECP notes that 90 % of the labour in the mining sector is employed in the two counties of Hunedoara and Gorj, where there is also a significant share of industrial plants with high GHG emissions, and coal power plants are also found in Timișoara, Arad, Suceava, Bihor and Iași. In its assessment of the draft NECP the Commission requested that Romania “integrate just and fair transition aspects better, notably by considering social and employment impacts”. (European Commission, 2019c) Although there are still no numerical estimates of the impact on jobs and economic growth in the final NECP, the document identifies investment priorities related to a just transition.

#### 4.2.2. Natural gas

Romania plans to tap natural gas resources in the Black Sea according to its final NECP. However, after the exit of Exxon from the Neptun Deep project (Energy Industry Review, 2020), OMV delaying its final investment decision (Offshore Engineer Digital, 2020), a lack of interest in expanding gas export capacity between Romania and Hungary (S&P Global Platts, n.d.) and the generally unfavourable investment climate in gas exploration caused by the covid-19 pandemic, the future of Black Sea natural gas seems uncertain. Romania needs to develop a plan B for a scenario where natural gas exploration is not expanded, which is in line with long term decarbonisation targets.

The final NECP states that in addition to existing routes, “Romania envisages in particular the development of the National System of Natural Gas Transmission on the Bulgaria-Romania-Hungary-Austria Corridor (BRHA) and the development of the Southern Transmission Corridor to take over the natural gas from the Black Sea shore.”( Government of Romania, 2020) Enhancing natural gas storage is also planned at five different strategic sites, including two which are projects of common interest.

The future role of natural gas fired electricity generation is unclear from the final NECP. On the one hand the NECP sees natural gas fired electricity generation capacity decreasing from 3344 MW to 2958 MW, on the other hand the NECP projects a total of 2902 MW new natural gas capacity (including both CCGT and CHP) coming online and the states that there is a prospect of “replacing several coal-based units with natural gas-supplied combined cycle units”. (Government of Romania, 2020) Specifically, 1260 MW of outgoing coal capacity of CE Oltenia will be replaced with 1400 MW natural gas capacity and 300 MW solar PV.

As with coal, the exact role of natural gas is difficult to assess from the NECP. However, it is clear from the listed projects in generation capacity, gas networks and storage, that significant investment is planned in the sector. Romania needs to closely assess whether these assets are likely to become stranded as the price of EUAs increases further and as emission reduction becomes more ambitious on the pathway towards net zero.

## 4.3. RES integration

### 4.3.1. Interconnectivity

According to the final NECP, “Romania meets the indicators for peak load (recording between 66 % and 75 % in the ratio between current interconnection and peak load capacities depending on the projection scenario) and installed renewable energy capacity (indicator ranging between 30 % and 44 % depending on the RES scenario).” (Government of Romania, 2020) The interconnection capacity of Romania is currently 7 % and is expected to increase to above 9% in 2020. By implementing projects of common interest, Romania is projected to achieve an interconnectivity level of 15.4% calculated as a share of total generation capacity by 2030, thereby meeting the 15% target applicable to all member states.

The NECP does not provide information on how an increase in the interconnectivity level is expected to contribute to balancing supply and demand in a system with higher levels of intermittent RES. The same applies to planned investments in the national grid. The NECP states that “Romania will maintain and extend the “Black Sea Corridor” and the “Mid Continental East Corridor” included in the priority corridor No 3 “Interconnections North-South for electricity in Central Europe and South-Eastern Europe”. These projects are meant to integrate production from renewable sources from Member States (Bulgaria, the Czech Republic, Hungary, Poland, Slovakia) and third countries (Serbia). Furthermore, the connection with Ukraine (Roşiori-Mukacevo) will remain functional and in use.” (Government of Romania, 2020) However the expected contribution of each link to integrating RES is unclear.

### 4.3.2. System flexibility

The NECP discusses the digitisation of the electricity system and implementation of smart management systems. It formulates visions related to turning the Romanian energy market into a “fit-for-RES” market” through digitisation and smart grids, and sets numerical targets for the number of smart meters installed during the period 2019-2028, in line with the Calendar of implementation of electricity smart measurement systems developed by the National Energy Regulatory Authority, aiming at the installation of a total of 4 034 430 meters.

With respect to storage, there are no numerical targets set. Future tasks include defining the concept of storage in legislation, defining standards for deployment and developing a market design. The NECP does not go far enough in determining a vision for storage and the role it will play in integrating RES.

## 4.4. Investment needs, financial support and harmful subsidies

The final NECP estimates that the planned additional measures represent a total investment value of approximately EUR 150 billion for 2021–2030 compared with the WEM scenario. The increase in investment cost is highest in the industry and tertiary sectors. In total, end use sectors will face an increased investment of EUR 127.4 billion, an additional EUR 9.8 billion will be required in electricity grids, and an additional EUR 12 billion will go to investment in electricity generation.

The NECP contains information on the sources of funding that will be used to support these investments as well as preliminary information on financial allocations to be made for different types of interventions.

Among current fossil fuel subsidies, the final NECP lists support to vulnerable consumers, including support for residential heating for heat, natural gas, electricity and wood, coal and oil, as well as subsidies for heating which are not targeted at vulnerable consumers but appear on the electricity

bill. The final NECP also mentions support to coal to facilitate the closure of uncompetitive coal mines as being the only form of support provided for coal. It does not mention support provided to the Oltenia Energy Complex for the purchase of EUAs. (REKK et al., 2020)

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