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Assessment of the draft updated National Energy and Climate Plan of Greece

Accompanying the document

COMMISSION RECOMMENDATION

on the draft updated integrated national energy and climate plan of Greece covering the period 2021-2030 and on the consistency of Greece's measures with the Union's climate-neutrality objective and with ensuring progress on adaptation

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Contents

1 SUMMARY

1.1 Overview of key objectives, targets and contributions in the draft updated NECP

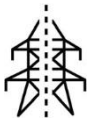
The European Green Deal, the fast-evolving geopolitical context and the energy crisis have led the EU and its Member States to accelerate the energy transition and set more ambitious energy and climate objectives, with a strong focus on diversifying energy supplies. These developments are reflected in the legislative framework adopted under the Fit for 55 package and the REPowerEU plan.

Greece's draft updated national energy and climate plan ('the draft updated NECP' or 'the plan'), submitted on 3 November 2023, partially takes into account this new geopolitical and legislative framework.

Table 1: Summary of key objectives, targets and contributions of Greece's draft updated NECP

		2020	Progress based on latest available data	2030 national targets and contributions	Assessment of 2030 ambition level
	Binding target for greenhouse gas emissions compared to 2005 under the Effort Sharing Regulation (ESR) (%)		2021: -30.3% 2022: -28.6% [1]	-22.7%	NECP: No ESR projections included. NECPR: -35.5%
	Binding target for net greenhouse gas removals under the Regulation on Land Use, Land Use Change and Forestry (LULUCF)		Reported net removals of -5.48 Mt CO_2 eq. in 2021	-1 154 kt CO_2 eq. (additional removals target) -4 373 kt CO_2 eq. (total net removals)	Projecting to meet the target but lack of credible pathway
	National target/contribution for renewable energy: Share of energy from renewable sources in gross final consumption of energy (%)	21.7% (2020 target 18%)	2021: 21.9%	44%	Greece contribution of 44% is above the 39.2% required pursuant the formula set out in Annex II of the Governance Regulation
	National contribution for energy efficiency:				

[1] The ESR emissions for 2021 are based on final inventory data and for 2022 on approximated inventory data. However, the final ESR emissions for 2021 and 2022 will only be established in 2027 after a comprehensive review.

	Primary energy consumption (Mtoe)	24.7 Mtoe	2021: 20.3 Mtoe	18.2 Mtoe	Greece's primary energy consumption contribution is 18.2 Mtoe. EED recast Annex I formula results: 17.1 Mtoe
	Final energy consumption (Mtoe)	18.4 Mtoe	2021: 15.2 Mtoe	15.4 Mtoe	Greece's final energy consumption contribution is 15.4 Mtoe. EED recast Annex I formula results: 14.6 Mtoe
	Level of electricity interconnectivity (%)	9.9%	5.6%	15%[2]	

Source: Eurostat; Greece's draft updated national energy and climate plan

1.2 Summary of the main observations[3]

Greece submitted its draft updated national energy and climate plan more than three months after the deadline of 30 June 2023[4]. The European Commission has therefore had limited time to draft its assessment to enable Greece to submit its final draft updated NECP by the legal deadline of 30 June 2024.

The draft updated NECP refers to the revised energy and climate targets recently agreed under the **Fit for 55** package and the **REPowerEU plan.**

The plan does not provide separate projections for greenhouse gas emissions under the **Effort Sharing Regulation** (ESR), which is essential to assess the likelihood for the draft updated plan to reach the ESR target of -22.7% in 2030 below 2005 levels. Projections under article 18 of the Governance Regulation that Greece submitted in March 2023 include a WEM scenario for the ESR sectors expecting 2030 emissions of -35.5% compared to 2005 levels, significantly below the ESR target.

[2] Calculated by the European Commission based on the ENTSO-E data (Winter Outlook 2022-2023). The 2030 level represents the general interconnectivity target of 15%. The level of ambition cannot be assessed, because the actual 2030 interconnectivity levels will depend on the implementation of the planned interconnectors and changes in the generation capacity. The 2020 figure covers also interconnectors with the neighbouring countries outside the EU.

[3] In addition to the notified draft updated NECP, this assessment also considers informal bilateral exchanges, which are part of the iterative process established under the Governance Regulation.

[4] Article 14 (1) of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action OJ L 328, 21.12.2018, p. 1–77.

On the regulation on **Land Use, Land Use Change and Forestry (LULUCF)[5],** the draft updated plan indicates that Greece will meet its 2030 target with existing measures. The plan lacks any substantial detail in the land sector and does not provide a clear implementation timeframe nor quantification of the impacts of specific policies and measures. It also lacks information on the status and progress in ensuring higher tier levels and geographically explicit datasets needed to ensure the robustness of net removal estimates.

The draft updated plan outlines the importance of **carbon removal technologies**, such as Carbon Capture and Storage (CCS), and provides projections of expected capacities for capture, storage and use up to 2050 but does not describe a detailed plan or the necessary funding to get there.

The draft updated NECP reflects no progress towards **international commitments under the Paris Agreement**. Greece does not indicate a precise phase out date for phasing out of lignite and does not provide information on the phase out of fossil fuel subsidies.

Regarding **adaptation to climate change,** the draft updated NECP does not contain an adequate analysis of the relevant climate vulnerabilities and risks for the achievement of the national objectives, targets, and contributions and the policies and measures in the individual dimensions of the Energy Union. Greece does not report on hazards related to heatwaves, droughts and floods in its climate risk and vulnerability assessment, whereas independent scientific sources point to an increasing risk on the country's territory caused by these hazards. The link to the specific Energy Union objectives and policies, which adaptation policies should support, is not specified or quantified. Adaptation policies and measures to support Greece´s achievement of national objectives, targets and contributions under the Energy Union are not properly described in terms of their scope, timing or expected impacts.

For **renewable energy**, the draft updated plan puts forward a contribution of 44% of renewables in the country's gross final energy consumption which is significantly above the share of 39% resulting from the formula in Annex II of Regulation (EU) 2018/1999 on the Governance Regulation of the Energy Union and Climate Action ('Governance Regulation'). Targets are also included for the heating and cooling and transport sector. However, the draft updated NECP includes only some tables with projections and does not include a target for industry or trajectories for renewables in any sector and misses the trajectories for renewable fuels of non-biological origin (RFNBOs). Overall, the draft updated plan takes into account Directive (EU) 2018/2001 on the promotion of energy from renewable sources as amended by Directive (EU) 2023/2413 ("revised REDII") to some extent. At the same time, it provides, for the most part, a comprehensive list of measures that Greece has adopted or intends to adopt to support the deployment of renewable energy. However, the implementation timeline is not clear, nor does the plan clearly distinguish between existing and new measures.

On **energy efficiency**, the draft updated NECP is informative and detailed. The increased ambition in Directive (EU) 2023/1791 on energy efficiency and amending Regulation (EU)

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[5] Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU (OJ L 156, 19.6.2018, p. 1).

2023/955 (recast) ('EED recast') has not been taken into account, although the level of ambition for the 2030 energy efficiency targets has been increased compared to the previous NECP. Greece's national contributions to the EU's 2030 energy efficiency targets amount to 15.4 Mtoe for final energy consumption, and 18.2 Mtoe for primary energy consumption, which are not in line with the theoretical results of the EED recast Annex I formula.

The **'energy efficiency first' principle** is considered and reflected across several measures. On planned measures, the draft updated NECP puts forward a set of comprehensive measures addressing especially the buildings and industry sectors. However, the draft updated NECP does not quantify the expected savings per measure, thereby making it difficult to assess their contribution towards the 2030 energy efficiency targets.

In relation to **buildings**, the Greek draft updated NECP includes milestones and measures relevant for the long-term building renovation strategy. A detailed presentation of several milestones for 2030, 2040 and 2050, referring to both the residential and service sector buildings, is included. It demonstrates that the 2030 ambition for most indicators has increased compared to the 2020 NECP. Several economic, regulatory, information, fiscal, and education measures are included in the draft updated NECP, but there is no information on the expected savings or impact of the individual measures.

On **energy security**, the draft updated NECP sets out targets and policies to enhance national security of energy supply. In the **gas sector,** the plan illustrates the significant energy diversification efforts already undertaken, especially in terms of replacing Russian energy imports. This is combined with a wide diversification strategy, focusing on LNG imports, the upgrade of the Trans Adriatic Pipeline (TAP) and the Greece-Bulgaria interconnector (IGB), the construction of the interconnector with North Macedonia and the Floating Storage Regasification Unit (FSRU) Alexandroupolis. The plan describes domestic gas exploration activities and ambitious targets for gas demand reduction and for renewable gases development to phase out Russian gas as soon as possible, although no timeline is provided for the latter.

In the **electricity sector**, the draft updated NECP describes a number of objectives including a focus on diversification and reduction of energy dependence with specific projects and some dedicated measurable targets. In the **oil sector**, the plan does not describe the expected outlook for oil consumption and import dependency by 2030 and does not assess the adequacy of the oil infrastructure (refinery, oil stocks) with the expected oil demand decline and the move toward lower-carbon alternatives.

On the **internal energy market,** Greece meets the 15% interconnectivity target by commissioning a second electricity interconnection with Bulgaria. The project which was identified as Project of Common Interest (PCI) in the 1st Union list of PCIs was commissioned in September 2023. The draft updated NECP refers to completing the liberalisation of the retail market, for instance by introducing measures to promote the active role of consumers, including the widespread deployment of smart meters by 2030. However, when it comes to demand response, the draft updated plan does not elaborate on the quantification of flexibility needs, nor does it set clear targets and objectives for demand response or flexibility. There are limited included policies and measures to enhance flexibility and enable a non-discriminatory participation of new flexibility services.

On **energy poverty**, the draft updated NECP provides an overview of the measures currently in place to protect and support both vulnerable consumers and energy poor households in terms of direct support (e.g., price support measures and other support schemes), energy efficiency and renewable energy support measures as well as educational actions. The specific measures are not always described in detail, however. The plan also does not include a concrete timetable for the planned measures, nor does it always provide a clear link between measures and specific targets for reducing energy poverty.

The draft updated NECP does not include a dedicated chapter on **research, innovation, competitiveness and skills,** as Greece is currently revising its priorities in this dimension which will be included in the final updated plan. The plan therefore does not outline the direction of its energy and clean technologies R&I and provides no quantitative information on future R&I targets, investments and trends towards 2030 and 2050. Moreover, the plan does not include priorities or policies for the research, innovation, and competitiveness dimension, other than that it aims to achieve commensurate progress and cost reduction for the technologies that will be needed and are currently under-development, such as energy storage, hydrogen and green synthetic fuels. The plan does refer to long-standing cooperation and bilateral scientific and technological cooperation agreements in force with other countries, including joint calls for research in the field of energy. The plan does not provide information on investments for domestic production of key net-zero technologies, equipment and components and how Greece will ensure resilience of its supply chains. There is no information related to funding of green skills, upskilling and reskilling, digitalisation and manufacturing of clean energy technologies.

Just transition is addressed in a very limited manner in the draft updated NECP**.** There is limited analysis of the social, employment and skills effects, or any other distributional impacts on vulnerable groups, of the energy and climate transition. Further, the plan does not elaborate on policies and measures to tackle these issues. In addition, the information provided in the draft updated NECP is different from that included in the Territorial Just Transition Plans (TJTPs). It is not clear what impact this could have on planned measures. Resources specifically devoted to supporting the just transition are not listed in detail. Finally, the plan does not provide sufficient information for the preparation of the Social Climate Plan or on how the consistency of the two plans will be ensured.

As regards its **strategic alignment with other planning tools**, the draft updated NECP covers the implementation of some of the measures included in the Recovery and Resilience plan ("RRP") and notably those in the new REPowerEU chapter which was endorsed by the Commission on 21 November 2023. Furthermore, the measures in the plan reflect the 2023 European Semester Country Specific Recommendations, in particular with regard to energy security, renewable energy and energy efficiency that will allow to reduce Greece's dependency on fossil fuels.

The assessment of the **investment needs** provides estimates for total investments as well as for some sectors and certain measures. These costs are compensated by reducing operating costs across all sectors of energy consumption and production. The investment needs are not separated into public and private.

Overall, it is not possible to analyse the quality of the quantitative **analyses underpinning** the draft updated NECP because it does not provide any description of the analytical tools used for the preparation of the plan. Furthermore, the methodologies used for WEM projections and impact assessment of specific policies and measures are not clearly

explained or referenced, nor do they contain a split between ETS and non-ETS sectors. The macro-economic impact assessment of the draft updated plan is qualitative and not very detailed, and the applied methodology is unclear.

2 PREPARATION AND SUBMISSION OF THE DRAFT UPDATED NECP

2.1 Process and structure

Greece's draft updated NECP was notified on 3 November, four months after the legal deadline. The plan is generally well developed and overall follows the structure provided by the Annex I template, covering to a certain extent all dimensions apart from the research and innovation dimension. It includes general objectives, targets or contributions for each of the covered dimensions, backed to a certain extent by policies and measures and underpinned by an analytical basis, including an impact assessment.

The plan also provides evidence that, in line with the Whole of Government approach, Greece reached out and worked together with all relevant authorities through its Inter-Ministerial Committee on Energy and Climate' to update the draft updated NECP, taking into account synergies and trade-offs across different portfolios.

Municipalities and regions have a significant role in the implementation of several measures and plans relevant to the dimensions of the Energy Union as well as in the implementation of both climate change mitigation and adaptation measures. The promotion of smart and sustainable cities and the concept of climate-neutral cities are also emphasised. The involvement of local authorities in the public consultation and stakeholders' participation processes is not explained in the plan.

2.2 Public consultation

The public participation procedure outlined in the plan included public participation before decisions were taken and throughout the decision-making process. A range of interest groups were identified and encouraged to take part (including social partners), however not covering ordinary members of the public. There is a lack of detailed information on adequate communication channels and mechanisms to notify and involve the public in the in the NECP update process. The time frame for the public to prepare and participate effectively is also unclear, as is whether necessary information was provided on the NECP's key objectives, targets and contributions. A clear summary of how the public's views were considered and addressed is not included in the plan.

The plan does not clearly explain whether a multilevel energy and climate dialogue involving local and regional actors has been established.

2.3 Regional consultations for preparing the draft updated NECP

While the draft updated NECP reflects bilateral cooperation on energy matters with other states (e.g., USA, Israel, Egypt), Greece did not consider input from the regional groups that it participates in when preparing the draft updated NECP, e.g. the Energy Community and Central and South-Eastern Europe (CESEC) high-level group. There have not been consultations of neighbouring countries such as Bulgaria and Italy for the preparation of the plan.

3 ASSESSMENT OF THE AMBITION OF OBJECTIVES, TARGETS AND CONTRIBUTIONS AND ADEQUACY OF SUPPORTING POLICIES AND MEASURES

3.1 Decarbonisation dimension

3.1.1 Greenhouse gas emissions, removals and storage

The plan fully embeds the increased climate targets included in the ESR and LULUCF Regulation, as well as part of the **Fit for 55 legislative package**.

The draft updated NECP confirms Greece's commitment to achieve climate neutrality by 2050. The draft updated plan shows concrete pathways to 2030, 2040 and 2050. The plan contains 'with existing measures' (WEM) projections to 2050, but does not contain 'with additional measures' (WAM) projections. The included projections show net greenhouse gas (GHG) emissions (i.e., including LULUCF and excluding international aviation) of 2.5 million tonnes of CO_2 equivalent (CO_2 eq.) by 2050. This is equivalent to a projected reduction in 2050 of 98% compared to 1990.[6] These projections represent an improvement over the projections submitted in March 2023 under Article 18 of the Governance Regulation, which showed a projected reduction in 2050 of 50% compared to 1990.[7] The information provided in the draft updated plan therefore confirms the assessment carried out in the 2023 Climate Action Progress Report that, based on the available information, progress by Greece is likely to be consistent with the achievement of the EU climate-neutrality objective.

The draft updated NECP sets an economy-wide target of reducing GHG emissions in 2030 to -55% compared to 1990 emissions. It expects that this target will be nearly achieved (-54%) excluding LULUCF CO_2 removals and over-achieved (-57%) if a higher contribution from LULUCF is achieved by then. It sets the priority in coming close to zero CO_2 emissions from energy production already immediately after 2035, so that electricity can help reduce emissions in the transport and buildings sectors through electrification.

The draft updated plan reflects the ambition under the ESR of reducing GHG emissions in 2030 by 22.7% below 2005 levels. As part of a pathway towards a climate-neutral economy, the draft updated plan includes an objective of reducing ESR emissions by 46% in 2030 compared to 2005. This represents a 23.3 percentage point greater domestic reduction target than the target set for Greece under the ESR. However, the plan does not provide separate projections for greenhouse gas emissions under the Effort Sharing Regulation (ESR), which is essential to assess the likelihood for the draft updated plan to reach the ESR target of -22.7% in 2030 below 2005 levels. Projections that Greece submitted to the Commission in March 2023 under article 18 of the Governance Regulation include a WEM scenario that expects emissions in the ESR sectors to be -35.5% compared to 2005 levels. The policies and measures are generally described in sufficient detail but in almost all fields there is a lack of information about the timing and likely impact. In

[6] Based on 2050 total projected GHG emissions of 8.5 Mt CO_2 eq. without LULUCF (Figure 4) and 6.0 Mt CO_2 eq. LULUCF removals (Table 3). The draft updated NECP itself reports a reduction of 99% (page 50). See, however, Section 9 on the robustness of the projections.

[7] In March 2023, Greece did not submit GHG emission projections under the additional measure scenario.

2021, Greece's ESR emissions were below the Annual Emission Allocation (AEA) by 2.3 Mt CO_2 eq.

Member States have **flexibilities under the ESR** to comply with their targets. No specific use of ESR flexibilities is reported by Greece. To assess whether Member States comply, the use of saved AEAs from previous years is taken into account.

Table 2: ESR target and projections in Greece's draft updated NECP

ESR target and projections[8]					
	2030 target*	**2021 performance (inventory data) ***	**2022 performance (approximated data) ***	**2030 WEM projection***	**2030 WAM projection***
Greece	-22.7%	-30.3%	-28.6%	-	-
EU	-40%	-14.5%	-16.9%	-22%	-29%

*Compared to the 2005 emissions as set out in Annex I of Commission Implementing Decision (EU) 2020/2126.

The draft updated NECP reflects the increased ambition of the LULUCF Regulation requiring Greece to deliver additional -1 154 Kt CO_2 eq. net removals to reach the total value – 4 373 Kt CO_2 eq. in 2030. The draft updated NECP states the net removals of the LULUCF sector is expected to decrease from -5.4 Mt CO_2 eq. in 2020 to -4.8 Mt CO_2 eq. in 2030 rising with existing measures. On this basis, Greece would achieve its target, however the plan provides no credible pathway. It is worth noting that the overall LULUCF sinks are projected to decrease by over 11% between 2020 and 2030.

The draft updated NECP does not quantify the **mitigation potential** of planned measures in the LULUCF sector. Thus, it does not provide sufficient details for a comprehensive assessment. According to the Greek authorities a more accurate estimate is expected to be provided by 2025. The plan includes several national programmes and plans which may contribute towards fulfilling the priorities in the land sector. Despite specifying the intention to align funding with climate measures in the sector, Greece does not provide details on how it will be distributed, neither by measure nor over time.

The draft updated NECP does not provide sufficient information on the status and progress to be made in ensuring the enhancements to higher tier levels/geographically explicit datasets for **monitoring, reporting and verification**, in line with the provisions under Regulation (EU) 2018/841 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework. The draft plan mentions an undergoing project for a forest monitoring system, but no details are provided. More information is expected for 2025. Overall, Greece does not clearly present how its policies and measures for the LULUCF sector will support the projections included in the plan.

[8] The comparison between the ESR target and emission projections does not take into account the flexibilities available for Member States under the ESR to comply with their 2030 targets. The ESR emissions will be comprehensively reviewed in 2027 (for the years 2021-2025) and 2032 (for the years 2026-2030).

In the **transport sector**, the plan includes policies and measures for energy efficiency, renewable energy sources, and for improved access to zero- and low-emission mobility. **The plan includes a 29% target for renewables by 2030**, however, detailed sub-targets are not provided. Biomethane production is set to increase, reaching 2.1 TWh by the end of 2030 and 3.3 TWh by 2035, however, a specific target is not set. Currently, there is no production of advanced biofuels in Greece, but the contribution is expected to reach 2.4% of transport fuels by 2030 and 17% by 2040. The draft updated plan contains several proposed measures to improve energy efficiency, such as electrification of the rail sector, and development of biofuel usage in the maritime and aviation sectors, but detailed plans are not provided.

The plan includes measures to promote active mobility (walking and cycling), including through mandatory sustainable urban mobility plans and a national action plan for promoting cycling. It also sets the goal of increasing the use of **electric vehicles** by 2030 and includes a national policy framework for alternative fuel infrastructure for low- and zero-emission vehicles and mobile assets across transport modes. This includes measures for recharging points and hydrogen refuelling stations aligned with the provisions of the new Alternative Fuels Infrastructure Regulation (AFIR).

The plan includes roadmaps and measures for the production and deployment of sustainable aviation fuels (SAF) in accordance with the Refuel EU Aviation Regulation and/or sustainable maritime fuels. In the aviation industry, the use of biofuels and synthetic exhaust will be considered, and the development of electrification infrastructure for aeroplanes will be envisaged, also based on relevant targets in the AFIR.

The plan includes measures for the electrification and the introduction of zero-emission technologies and related infrastructure in **rail, ports and airports**, and modal shift towards low-carbon modes (e.g., fiscal measures, deployment of infrastructure for zero-emission aircrafts, shore-power infrastructure at ports). The co-benefits of these measures for air quality are also explained and quantified.

The plan identifies Carbon Capture Utilisation and Storage (CCUS) as one of several strategic priorities. It aims in the short term to create a carbon capture and storage value chain in Greece that will mainly help industry in hard-to-abate industries and processes (water production, oil refinery, fertiliser, and alternative fuels manufacturing) but also in shipping. In terms of projections of potential CO_2 capture volumes, the plan indicates that 0.932 Mt of CO_2 will be captured annually by 2035, 3.287 Mt by 2040, 3.447 Mt by 2045 and 3.653 Mt of CO_2 will be captured annually by 2050. It is not clear how much CO_2 will be captured from biogenic sources. While no precise estimations have been made for 2030, it is mentioned that industrial emissions that could be captured and stored may reach 15 million tonnes per year as early as 2030.

Estimations of available CO_2 storage capacity have been made for 2040 (4.363 Mtpa), 2045 (4.577 Mtpa) and 2050 (5.395 Mtpa). For 2030 and 2035, estimations will be reviewed based on the progress of Prinos CO_2 storage site, which is strongly related to the timetables of selected Innovation Fund projects in Greece (the IRIS project for CO_2 capture at the hydrogen production plant of a refinery in Corinth, and the IFESTOS project for CO_2 capture in a cement plant in Viotia). Prinos, the first CO_2 storage plant in Prino, Kavala, is already covered by the Recovery and Resilience Fund for co-financing. The plant will have a capacity to absorb 2,5 million tonnes of CO_2 per year in full operation. It

is estimated that the first phase (for a capacity of around 1 million tonnes per year) will be completed by the end of 2025 and the second phase (full capacity) by the end of 2027.

The completion of the relevant **regulatory framework for CCUS** of CO_2 is also reported to be progressing. The plan does not provide details on how the CO_2 will be transported. The importance of BECCS and DACCS technologies is noted, and their use considered. The technologies are under development; however, no detailed plans are outlined.

The draft updated NECP pays some attention to mitigating non-CO_2 emissions in different sectors. On **methane**, the plan addresses waste management (e.g., M4 reduction in quantities of biodegradable waste; modernisation of wastewater treatment plants), including an outline of relevant EU and national legislation (e.g., Law no. 4819/2021), and provides several measures for the development of biogas and bio-methane (e.g., upgrading of existing biogas plants into-bio methane plants; injection of bio-methane into the natural gas distribution network; organisation of a raw material collection system).

The plan contains few details on N_2O emissions, mentioning only the EU Nitrates Directive. Similarly, the plan lists a measure in agriculture (i.e., M28 reduction of agricultural emissions) but explains neither the emission sources nor the types of interventions. On F-gases, the plan refers to EU legislation and emphasises inspections and penalties carried out by competent authorities (e.g., M27 reduction of fluorinated gas emissions). The plan does not provide quantified projections, which makes it difficult to assess the impact of the policies. These shortcomings are problematic, because HFCs from refrigeration and air conditioning, methane emissions from landfill sites, and N_2O from agricultural soils represented 10%, 9% and 6%, respectively, of the 2021 value defined in Regulation (EU) 2018/842.

The draft updated NECP reflects no progress towards **international commitments** under the Paris Agreement. It includes measures to continuously reduce lignite production with the aim to phase it out after 2028 (mentioning this could take place earlier), but without indicating a precise cut-off date for phasing out of lignite. A reduction in emissions after 2023 is due to the retirement of lignite-fired plants. The phase-out of fossil fuel subsidies is not discussed at all in the draft updated plan.

On 8 January 2020, Greece submitted to the Commission its national long-term strategy. While the strategy did not include the goal of achieving climate neutrality by 2050, it is included in Greece's report on the status of implementation of its initial NECP submitted in March 2023. The goal is legally binding.

3.1.2 Adaptation

The draft updated NECP acknowledges the importance to prepare for the impacts that climate change may have on energy planning and the achievement of national climate neutrality targets. It discusses the significant **impact of climate change on the energy system** and related infrastructure in Greece. It highlights vulnerabilities such as reduced water availability affecting thermal and hydropower plants, extreme weather events threatening electricity networks, and rising sea levels posing risks to coastal gas infrastructures. The weather disasters of September 2023 caused by Storm Daniel exemplify the repercussions, causing damage to power plants, transmission substations, and critical infrastructure, disrupting services and potentially increasing greenhouse gas emissions. However, the plan lacks a complete and detailed risk assessment.

The draft updated NECP contains a rather long list of relevant **policies and measures** put in place or planned for safeguarding forests, energy efficiency, renewables and security of the energy system but they are merely listed and not properly described.

No **nature-based solutions** are reported, while water-related issues are discussed. Innovative approaches such as insurance policies and fiscal measures addressing the climate protection gap are not considered. Investments aimed at minimising environmental impacts, such as biodiversity loss are also not considered. The general objectives in the national adaptation strategy (NAS) are in line with the ones of the draft updated NECP: to contribute to better decision-making through personnel training and better available information and scientific data; to strengthen planning for adaptation at local and regional level; and to promote a network of actions and policies in all areas, with a particular focus on the most vulnerable. The aim is to set up a mechanism for monitoring and evaluating adaptation actions and policies, and to inform and raise awareness among citizens.

3.1.3 Renewable energy

The renewable energy contribution proposed in the draft updated NECP is a share of 44% of the national gross final consumption of energy in 2030 and based on the WAM scenario including absolute values in terms of energy. This contribution is significantly above the share of 39% resulting from the formula in Annex II of the Governance Regulation. The scenarios do not provide yearly overall renewable energy contribution trajectories by technology but include trajectories in five years intervals up to 2050. The indicative trajectory with the reference points for 2025 and 2027 to reach the 44% contribution in 2030 has not been provided.

The renewable electricity generation is projected to reach 82% in 2030 in gross electricity consumption[9], with solar power becoming the main source of renewable electricity (13.4 GW of projected installed capacity). The draft updated NECP mentions the importance of hydropower potential projected to reach 3.8 GW of installed capacity in 2030 compared to 3.1 GW in 2021. No projections have been included for bioenergy for electricity generation – the plan only states that 99 biogas power plants are in operation with a total capacity of 116 MWe, without giving any further information.

Projections show that the share of wind power and installed capacity is projected to roughly double in 2030 compared to 2023 (9.5 GW, of which 1.9 GW offshore). However, Greece indicates that the estimates for offshore wind capacity (1.9 GW, 9.8 GW and 29.2 GW capacity for the target years 2030, 2040 and 2050, respectively) are to be finalised in view of the final updated NECP. More specifically regarding offshore wind power capacity, the draft updated NECP puts forward capacity development goals in line with the non-binding agreements laid down in the offshore communication published in January 2023.

The draft updated plan does not include information on the innovative target for renewable energy deployment; however, it makes a reference to the importance to develop innovative forms of renewables deployment such as ocean energy, floating photovoltaic and geothermal energy, for which the regulatory framework for exploitation has recently been completed and a call for interest for the lease of geothermal exploration rights in four areas of Central – East Macedonia and Thrace is under way.

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[9] Greece sets a target for RES electricity generation in 2030 of 82% of domestic electricity generation.

Greece sets a target for the development of **renewable energy in the heating and cooling sector** at 46% by 2030 with the main contribution coming from heat pumps and solar thermal systems. The corresponding increase is above the binding target set in the revised REDII, but below the indicative top up resulting in a 2.1 percentage point average increase over 2021-2030. The draft updated NECP does not describe how Greece intends to increase renewable energy in heating and cooling by the percentage points as an annual average calculated for the periods of 2021-2025 and 2026-2030, in line with the revised REDII. The role of waste heat and cold and the accounting of renewable electricity in the trajectory also remains unclear.

Heat pumps are expected to grow rapidly. Greece estimates that the heating demand for 17% of residential buildings are expected to be met by air-to-water heat pumps in 2030, and by 91% in 2050. The increased penetration of heat pumps in the case of tertiary sector buildings is expected to be close to 69% and 90% in 2030 and 2050 respectively, and it is mentioned that the use of heat pumps in heating and cooling will almost double in 2030 compared to 2021. However, information on the volumes of electricity needed to run these heat pumps and the projected capacity is not included in the plan. Overall, from the information provided it is difficult to ascertain whether the measures will be sufficient to achieve the target in heating and cooling in line with the Directive (EU) 2018/2001 as amended. Regarding bioenergy, the draft updated NECP states that there is no intention to extend the use of biomass for combustion in city buildings to avoid air pollution. According to the estimations included in the draft updated NECP, in the heating and cooling sector, biomass will decrease from 1702.8 ktoe in 2021 to 748.8 ktoe in 2030, and to 521 ktoe in 2050.

The draft updated plan does not include a **share of renewable energy in buildings and industry.** Greece indicates that it projects a small share of renewables in district heating networks using mainly geothermal energy, biomass and renewable gases but without specifying further. Overall, the role of waste heat and renewable electricity in the accounting of the district heating and cooling, buildings and industry sub-targets remains unclear.

In the transport sector, the share of renewable energy is set at 29% in 2030 energy terms. Greece has not provided the equivalence of the target in GHG reduction. For the transport sub-targets, the main measures are the promotion of biofuels/bio-methane aiming to achieve 705,000 toe in 2030, and the introduction of quota for the consumption of conventional and advanced biofuels by 2030 covering all transport modes. Advanced biofuel is expected to reach a share of 2.4% in 2030 and RFNBOs a share of 1% by 2030 of transport fuels. The draft updated NECP includes a target of 460,000 electric cars by 2030 and provides extensive details about measures related to electro-mobility (both relating to electric vehicles and to recharging infrastructure). However, the plan mostly relates to existing measures.

The draft updated NECP includes an estimation for renewable hydrogen production to reach at least 0.92 TWh in 2030 corresponding to an electrolysis capacity of 300 MW. Moreover, the draft updated NECP reports that 3 GW of additional renewables capacity is considered for hydrogen production and that the total green hydrogen consumption is estimated at 63.6 TWh/year by 2050. Only two small research units and a small commercial electrolytic hydrogen production plant have been built so far. Some hydrogen production projects and plans on a pilot basis receiving funding from EU programmes have been made public.

The draft updated NECP does not include a specific target for RFNBO use in demand sectors in transport and industry. It is only mentioned that it is expected that the use of RFNBOs will reach 1% of transport fuels by 2030 (23.8 ktoe) and 23% by 2040 (1,360.7 ktoe) and in heating and cooling a projection of 79.8 ktoe in 2030 and 605.6 in 2040.

Regarding **international partnerships** to facilitate imports of renewable hydrogen, the draft updated plan does not contain information on agreements, Memoranda of Understanding (MoUs), bilateral talks or similar. Greece only refers to the potential of becoming a node for the import of green hydrogen from North Africa and Middle East to export to Europe, stressing the need for appropriate infrastructure but without providing further details on specific steps for agreements and/or collaboration with other countries.

Policies and measures to support the achievement of the proposed objectives and contributions for renewable energy lack sufficient details in reference to legal acts, scope, timeframe expected impacts. Greece describes in general terms the sectors and the need for specific types of measures that should be promoted but does not include concrete measures to be implemented for most of the sectors, and for almost all measures there are no specific timelines and impacts included.

In the **electricity sector** the objective is to accelerate the production of electricity from renewable energy through the promotion of Power Purchase Agreements. This will be supported through the development of a central trading platform. The goals of this measure are to promote the financing and development of renewable energies and by providing a simpler and standardised framework for bilateral PPAs. The PPA platform will facilitate the conclusion of PPAs by reducing the risk of counterparties.

On **guarantees of origin,** Greece aims to enhance the current system through an auctioning mechanism that is expected provide revenue for the support of renewable electricity deployment. When it comes to **joint projects,** Greece has agreed to extend the collaboration under the intergovernmental agreement for the EastMed Gas Pipeline. Greece also refers to a joint declaration with Cyprus and Israel which supports their cooperation in the field of renewables, alternative fuels, electric vehicles, and innovation. Moreover, Greece states that it signed a Memorandum of Understanding (MoU) with Cyprus and Jordan in 2018, whose aim is the exchange of information and know-how, policy development, education and actions on renewable energy sources, energy efficiency, innovation and research as well as the exchange of knowledge, best practices and pilot projects in buildings, with particular emphasis on the promotion of nearly zero-energy buildings and the integration of RES systems and technologies. In 2022, Greece also signed a MoU also with Saudi Arabia for cooperation in the field of energy, including renewables. However, little detail is provided on these agreements in terms of progress and deliverables, especially related to renewables.

As regards **buildings**, Greece indicates that particular emphasis will be placed on removing barriers to installation of renewables and storage systems in buildings through targeted adaptation of the buildings regulation. Individual and collective self-consumption of renewable energy (up to 10.8 kW) as well as renewable energy communities is considered as a means to achieve these objectives. Self-consumption will be promoted through the reservation of 10 MW per substation for self-consumption plants of up to 10.8 kW (for households, farmers, and small-medium enterprises), subsidy programmes for the installation of PVs with battery and the establishment of a specific framework for

simplified procedures for connecting the installation of photovoltaic plants in buildings, and the promotion of collective self-consumption.

The draft updated plan presents few sufficient and well-described measures for promoting individual and collective **self-consumption** as well as **energy communities and energy citizens communities.** For the latter, the measures mentioned are administrative simplification, the creation of a special advisory mechanism for technical assistance with the aim to further promote energy communities and investment and operational support. The draft updated plan includes an estimation that the aforementioned subsidy programme will lead to the installation of 150 MW of small PV stations with batteries for self-consumption. However, the measures regarding the promotion of renewable energy communities do not indicate targets, anticipated impacts and specific timelines for the conclusion of these measures.

Greece has not indicated in its draft updated NECP whether it has put in place a **strategy on energy system integration**, but it includes several measures to support battery storage for excess renewable energy, also promoting flexibility services via demand response and storage. It is mentioned that dynamic pricing will be promoted through the uptake of smarts meters which is also key for the uptake of e-mobility. In the context of promoting storage, Greece refers to the existing support scheme to renewable power plants with an integrated storage system and stressed the need for additional policies in this regard.

Measures for **renewable heating and cooling** included in the draft updated NECP aim at promoting heat pumps and thermal solar systems, contributing both to the improvement of energy efficiency and to the further penetration of renewables in heating and cooling. For instance, Greece refers to programmes for the installation of photovoltaic systems coupled with storage to be used via heat pumps. Moreover, the use of renewable energy in heating and cooling is strengthened mainly by the programmes to reduce greenhouse gas emissions in buildings, such as a ban on the sale and installation of heating oil burners and the replacement of old and energy-intensive appliances with new, more energy-efficient appliances. In addition, Greece indicates that bioenergy use in residential and industry sectors will be an important step towards reducing dependence on fossil energy sources and reducing greenhouse gas emissions but without indicating estimated impacts, and contradicting wording elsewhere in the NECP which states that there is no intention to extend the use of biomass for combustion in city buildings to avoid air pollution. Specifically, the draft updated NECP refers to promoting use of waste from certain industries for the use of local district heating networks.

Regarding **industry**, the draft updated NECP stresses the importance of the penetration of renewables in electricity generation and the substitution of natural gas by electricity in industry as well as the gradual substitution of grey hydrogen consumed in industry and refineries by “green” (and “blue”) hydrogen, since the use of hydrogen will be prioritised to sectors of use that cannot be directly electrified, such as heavy road transport, nautical and aviation, as well as certain industrial applications (steel industry, cement, refineries, ammonia production, etc.). Moreover, the draft updated NECP refers to the need to support the scaling up of renewable hydrogen production on an annual basis, as well as the technical and economic maturation of hydrogen in hard-to-electrify industry sectors through potential support from the European Hydrogen Bank. However, the draft updated plan falls short of further detail including on estimated impacts of those measures.

Measures to promote **bioenergy** availability and bioenergy sustainability have not been exhaustively included; specifically, the draft updated plan does not contain projections till 2030 (or up until 2040) for the electricity and heating and cooling sectors, but only some projections for the use of biofuels/biomethane in the transport sector. The cascading principle has not been highlighted exhaustively. The plan has not assessed the impact that bioenergy trajectories may have on LULUCF sinks, biodiversity and air quality. However, the draft updated plan announced that Greece does not plan to extent the use of biomass for combustion in city buildings, to avoid air pollution. The draft updated NECP does not include the assessment of the domestic supply of forest biomass for energy purposes in 2021-2030 in accordance with the strengthened sustainability criteria of Directive (EU) 2018/2001 as amended, and of the compatibility of the projected use of forest biomass for energy production with Greece's obligations under the revised LULUCF Regulation, particularly for 2026-2030. Regarding biomethane, the draft updated NECP does provide trajectory of Greece till 2030 (2.1 TWh or 0.21 bcm) but without sufficient details.

The plan includes a **mapping of the areas** including on the designation of renewables acceleration areas for **deployment of solar energy**. Specifically, the Greek draft updated NECP mentions that in the specific spatial planning framework, the areas in which all or part of the installation of renewable energy plants are permitted or excluded will be set together with the conditions for the installation of such plants, taking into account criteria such as nature, environmental protection, carrying capacity and anthropogenic activities of each site. Following that, a renewable acceleration area will be set after the conclusion of strategic environmental assessment, but no reference to the revised RED is included. For the streamlining of administrative procedures and time limits for granting permits, the plan does not include a reference to a contact point for project promoters of technology of a certain threshold. The draft updated plan includes a reference to the way offshore renewable development is addressed in the maritime spatial plan. The need to streamline administrative procedures for renewables in general is mentioned without specifying for sectors and technologies, and information is missing on the additional human resources dedicated to permitting.

3.2 Energy efficiency (including buildings) dimension

Energy savings are presented in the draft updated NECP, with Greece targeting to reduce energy consumption by 76 ktoe per year until 2030 compared to the 2017-2019 average.[10] This corresponds to a corrected **national contribution** of 18.2 Mtoe for primary energy consumption (compared to 17.1 Mtoe according to the EED recast Annex I formula results) and 15.4 Mtoe for final energy consumption (compared to 14.6 Mtoe according to the EED recast Annex I formula results). Greece's reported 2030 contributions deviate from the result of the formula in the EED recast Annex I by 6.3% and 5.5% for primary and final energy consumption respectively.[11] The target for 2030 is also set at a lower level as compared to the Greece 2020 energy efficiency targets that is -26.3% for primary and -16.3% for final energy consumption respectively[12]

[10] Calculations by JRC: The 2017-2019 average has been calculated based on the EED recast FEC definition, and the savings per year have been calculated for the period 2021-2030.

[11] According to Article 4(4) EED recast, a Member State shall ensure that its contribution in Mtoe is not more than 2.5% above what it would have been had it resulted from the EED recast Annex I formula.

[12] The comparison has been done with the 2020 targets of 24.7 Mtoe PEC, 18.4 Mtoe FEC).

The target on reducing total final energy consumption of all **public bodies** is not well described in the draft updated NECP but it includes well-reasoned information regarding the measures planned, without including the information on the exclusion/inclusion of public transport or armed forces. Greece opted, in line with 2014-2020 period, for the default approach as regards the public buildings' renovation target pursuant to Article 5 EED (Article 6 EED recast) on **exemplary role of public bodies' buildings**. The 3% annual renovation obligation of public buildings is mentioned, but without any target on square meters. Information on the total floor area is also missing.

The draft updated NECP provides satisfactory information on what measures will be used to deliver the savings required post-2020 under Article 7 EED (Article 8 EED recast) on **energy savings obligation**. Greece adopts a mixed approach, including both an energy efficiency obligation scheme and alternative measures. The policies and measures contained in the draft updated NECP under the energy efficiency dimension are sufficiently described but they do not include an adequate estimation of energy savings. More details are needed to understand how these measures contribute to the achievement of the 2030 energy efficiency contributions.

The draft updated NECP presents in detail the planned measures to achieve the 2030 energy efficiency goals, but their expected savings and related financial needs are missing. The new measures adopted after 2020 and the new planned measures to reach the higher 2030 target are well presented in the draft updated NECP, which also includes measures reflecting the **'energy efficiency first' principle**.

There are 30 main measures envisaged, addressing mainly the **building sector** (residential, public and services) and the industrial sector. There are also cross-cutting measures included, but no measure on transport under the energy efficiency dimension. It is not possible to assess which sector or which measures will have the highest ambition due to missing information on expected savings.

The Greek draft updated NECP includes measures promoting **energy audits and energy management systems**. However, there is no information on the number of obliged companies nor on the number of audits carried out.

The Greek draft updated NECP includes milestones and measures relevant for the **long-term building renovation strategy** (LTRS) and the building sector. A detailed presentation of several building sector milestones for 2030, 2040 and 2050, referring to both the residential and service sector buildings, has been included in the draft updated NECP. The plan demonstrates that the 2030 ambition has increased for most indicators compared to the 2020 NECP, and for a few indicators ambition has stayed at the same level. It is not possible to assess whether the ambition for 2040 and 2050 has increased compared to the 2020 NECP[13].

The indicators for 2030, 2040 and 2050 include, for example, yearly **renovation rate** in the residential and service sectors, average savings due to renovation and average consumption (kWh/m2 year) in dwellings. They also include the share of dwellings and service buildings with heat pumps for heating, carbon footprint of energy in dwellings and

[13] There was no information about 2040 and 2050 milestones in the final NECP 2020. On the other hand, the comparison with LTRS 2020 targets is also hard to be done because they seem to be expressed differently.

the service sector (tCO_2/toe), share of electricity in the residential sector, share of newly built and renovated service buildings and energy per unit of added value (toe/MEUR). For example, looking at the residential sector by 2030, the yearly renovation rate was raised compared to 2020 NECP from 1% to 1.4%. The average energy savings from renovation rose from 70% to 76%, the percentage of total dwellings extensively renovated from 16% to 19% leading to a reduction of the average consumption from 131 to 112 kWh/m2. The target share of dwellings with heat pumps for heating is increased from 7% to 17%, whereas the electricity share in residential consumption is maintained at 47%.

Several measures targeting the **building sector** are included, although it is not explicitly mentioned if all the measures contribute to the LTRS. These measures include economic, regulatory, information, fiscal, and education actions. There is no information on the expected savings and impact of each of these measures. No information on barriers has been identified and wider benefits of policies and measures are not listed. Almost all of the reported measures were included already in the NECP 2020.

3.3 Energy security dimension

Fossil fuels represent the bulk of the energy supply in Greece, accounting for 82% of the national energy mix in 2021[14]. The share has decreased over the past decade, representing 92% of the energy needs in 2011. The draft updated plan does not provide any forecast on the evolution of this indicator. At 81%, Greece has the highest **energy import dependency** on third countries in the EU, with the share having almost constantly increased since 2013, where the figure was around 68%[15].

According to the draft updated NECP, a key objective related to energy security is to drive down the energy dependence ratio, from 75% today to 66% in 2030, and to 9% in 2050[16]. Greece pursues the objective of becoming the main energy hub in the region while diversifying its own and the region's security of gas and electricity supply. Greece considers **regional energy cooperation** to be significant for both energy security and for the resilience of energy systems. In this context, Greece has signed several Memoranda of Understanding, for example with Egypt and Bulgaria, to increase the resilience of its energy system.

Natural gas is the second largest energy source of the country and the largest source for electricity generation, accounting for 25% of the energy mix and 41% of the electricity mix[17]. Most of this gas is imported. In 2022, according to the plan, Greece was dependent on Russia for 39% of its gas imports. Greece does not have any underground gas storage facility, and the draft updated plan does not refer to any changes in this regard.

In terms of **diversification**, the draft updated plan refers to 9 exploration sites that are currently being investigated to produce gas domestically. These sites have a capacity of 680 bcm according to what is described as a conservative estimate in the plan, which does not specify however whether this estimation refers to technically or economically

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14 Eurostat data.
15 Eurostat data.
16 This indicator includes imports from other EU Member States, and not only those from third countries as the other indicator used in the paragraph above.
17 https://energy.ec.europa.eu/data-and-analysis/eu-energy-statistical-pocketbook-and-country-datasheets_en.

recoverable reserves. Greece also plans to further develop its gas interconnections, notably upgrade the Trans Adriatic Pipeline (TAP) (10 bcm/year by 2027); increase the Greece-Bulgaria interconnector (IGB) capacity (from 3 to 5 bcm/year) by 2025 and complete the construction of the interconnector with North Macedonia with a capacity of 1.5 bcm/year. A Floating Storage Regasification Unit (FSRU) in Alexandroupolis is also planned to be commissioned by 2024, although its capacity is not specified. Further plans include the construction of a FSRU in Korinthos and the implementation of Eastmed pipeline. In terms of low-carbon gases, the plan aims at increasing biomethane consumption to 2.1 TWh in 2030 and 9.7 TWh in 2050, while green hydrogen consumption is expected to reach 0.92 TWh by 2030 and 63.6 TWh by 2050.

As a consequence of Russia's invasion of Ukraine, Greece has reduced its gas demand by 17% between August 2022 and August 2023, which is more than the -15% voluntary objective and slightly less than the EU27 average (-18%)[18]. According to the plan, gas demand in the country is expected to decrease from 4.9 bcm in 2022 to 3.2 bcm in 2030 and to 0.7 bcm in 2050. However, the draft updated plan does not describe the measures that have been adopted to reduce gas demand nor explain how they are integrated into the medium-term planning towards 2030. Overall, the draft updated NECP describes targets to strengthen national security of gas supply but does not provide much detail on the measures to reach them.

In the **electricity sector**, there is a project to interconnect most of the existing 28 autonomous island electricity systems to the interconnected system. A second key objective is to safeguard system adequacy to meet electricity demand while rapidly integrating renewable energy sources and other technologies (e.g. storage systems). The plan estimates that electricity generation from renewable energy sources in 2030 will be around 29 GW, based on the investment plan for the development of the transmission system (which will need to be adapted in order to accommodate the grid to the growing amount of variable renewables). Greece aims to strengthen the transmission system infrastructure to make it easier to connect new renewable energy plants to the transmission system. In this context, the plan mentions smart meters and smart grids as important measures to facilitate demand response and support the integration of renewables into the electricity system. The draft updated NECP also mentions electricity storage capacity for these purposes.

Finally, the plans describes the security of supply policy measures for the period 2023-2030 with five different priorities: enhanced diversification of energy sources and routes; reduced energy dependence and aim to become a regional energy hub; more flexibility, storage and demand response systems; readiness of the bodies involved in responding to the restriction or interruption of energy supply; and increased resilience of critical energy infrastructure. In particular, storage is expected to lead to a significant increase in the penetration rate of renewables' production.

[18] DG ENER Chief Economist Team based on ESTAT NRG_CB_GASM (sub-series IC_CAL_MG subtracted by TOS) in TJ (as of 29 September 2023, 11:00).

According to a study on **storage** commissioned by the European Commission, the current operational Greek energy storage capacity is around 699 MW (only pumped hydro)[19], which roughly corresponds to the figure provided in the plan (0.7 GW). It is positively noted that the draft updated NECP provides a forecast for the deployment of energy storage capacity of 5.3 GW in 2030 (2.2 GW pumped hydro and 3.1 GW batteries), which is an estimate that is almost twice as high the one of the 2019 version of the plan, an increase in ambition that is positively noted. The forecast for storage for 2050 is 24.8 GW (2.2 GW pumped hydro and 22.6 GW batteries). For each of these priorities, a number of projects are described and summarised by a detailed table.

Oil represents 52% of Greece's final energy consumption, divided mostly between transport (44%) industry (17%) and international bunkering (18%). Greece is fully dependent on crude oil imports, but main suppliers are well diversified with Iraq, Kazakhstan and Libya the main sources. Greece stopped importing Russian oil and oil products after the Russian invasion of Ukraine, with Russian oil products comprising 21% of Greek supplies before the war. Greece became a net exporter of oil products in the last decade with four oil refineries and two major oil ports and holds the required amount of emergency oil stocks in line with the oil stockholding directive (2009/119/EC). The draft updated NECP notes the planned oil pipeline between Greece and Bulgaria that would improve oil security of supply in the latter.

The plan does not describe the expected outlook for oil consumption by 2030. The reduction of import dependency by 2030 is set out as a general goal in the plan, but no policy measures are described to achieve this goal. The plan does not assess the adequacy of the oil infrastructure (refinery, oil stocks) with the expected oil demand decline and the move toward lower-carbon alternatives.

Cybersecurity is covered in the plan as a key prerequisite to the digitalisation and the overall electrification of the energy system. The plan mentions the need to establish a cybersecurity strategy in line with the NIS2 Directive, although this has not yet been done. Greece has set the goal of creating a national strategy on cyber security of energy networks by 2025. However, it does not outline a detailed plan to achieve this objective.

The plan also refers to the **resilience of the supply chains** in terms of access to critical raw materials needed for the green transition, and Greece will notably promote international tendering procedures for exploration and exploitation rights and accelerate domestic mining projects.

The plan also very substantially addresses the foreseen **impact of climate change** on the Greek energy system, by referring notably to changes in the consumption patterns due to rising temperatures or to the negative impacts on hydropower output linked to the reduced availability of water resources. It is also positively noted that the plan also puts forward several policy actions to strengthen the adaptation of the Greek energy system to climate change, such as studies assessing the climate resilience of existing energy substructures

[19] This figure is derived from the database which accompanied the ENTEC study on Storage funded by the European Commission and published in November 2022, by taking into account only the "operational" facilities: https://op.europa.eu/en/publication-detail/-/publication/dfcaa78b-c217-11ed-8912-01aa75ed71a1/language-en?WT_mc_id=Searchresult&WT_ria_c=37085&WT_ria_f=3608&WT_ria_ev=search&WT_URL=https%3A//energy.ec.europa.eu/.

and installations or the impact of climate change on hydropower generation, improvements to the energy sector's efficiency in terms of water needs, or research and development on modern methods to protect energy networks against extreme weather events.

The draft updated NECP only very briefly refers to measures in the **event of security of supply crisis** for electricity and for gas. Nevertheless, Greece submitted its National Risk Assessment, Preventive Action Plan, Emergency Plan, as well as the Common Risk Assessments for Trans-Balkan (which it coordinated), Caspian, Algeria, and Ukraine regional risk groups. At the time of writing, they are all being assessed by the European Commission.

3.4 Internal energy market dimension

In terms of further interconnecting the Greek electricity market, Greece met the 15% **interconnectivity target** by effectively commissioning the second electricity interconnection with Bulgaria. The project, listed as PCI, is commissioned in September 2023. The Greek Transmission System Operator (IPTO) has an important role in the EuroAsia interconnector, that would end the electricity isolation of Cyprus and is listed in the 5th Union list of PCIs. A major step towards the enhancement of the regional gas security of supply was the completion of the gas interconnector Greece-Bulgaria (IGB), a Project of Common Interest, that was supported by the Commission from the financial and regulatory perspective. For 2030, the interconnectivity ratio is expected to reach 23.1%.

While **energy infrastructure projects** are mentioned, the draft updated plan does not include any priority actions on harmonising with neighbouring countries gas quality standards which is one of the regulatory measures that is needed to enable unhindered transportation of non-Russian natural gas arriving in Greece within South-East Europe. Such actions are being taken in CESEC High-Level Group with active participation of the Greek Government and gas TSO.

The draft updated NECP refers to completing the **liberalisation of the retail market** by introducing measures promoting amongst others the **active role of consumers** These measures encompass the Greek DSO's plans for the widespread deployment of smart meters by 2030, involving an appreciable €1.1 billion investment and covering 7.7 million metering points. Smart metering serves as a crucial prerequisite for enhancing consumer engagement in the market. While progress has been gradual, with 13,000 smart meters deployed at the medium voltage level and 70,000 at the low voltage level since 2021—primarily for high electricity demand meters—there was notable improvement in 2022, with the installation of 100,000 smart meters. Anticipated acceleration in deployment rates in the upcoming years aims to achieve the targeted milestone by 2030.

When it comes to the importance to increase flexibility of the energy system, the draft update plan did not elaborate on the quantification of flexibility needs, nor does it set clear targets and objectives for demand response and flexibility with limited policies and measures included enable a non-discriminatory participation of new flexibility services. It only included succinct references to note that the use of smart-meters and smart networks will enable the integration of renewables into the grid.

Concerning consumer protection, the draft updated NECP outlines various supportive initiatives. These include the implementation of social tariffs to alleviate the effects of the energy crisis and the introduction of a regulatory package designed to safeguard

households facing challenges. However, the document does not provide details on these actions. The digitalisation of the national energy market appears to be progressing, since Greece is currently implementing several new measures in this field, such as the adoption of smart meters and an extension of the digitalisation of the energy network. At least this regard, there appears to be alignment and consistency with the broader national energy strategy.

Regarding **energy poverty**, the draft updated NECP identifies 12,4% of number of households in energy poverty on the basis of an index that takes into account the annual energy cost and the disposable income of each household. The draft updated NECP considers energy poverty as a particularly significant problem, and establishes a national objective to reduce energy poverty, by 50% in 2025 and by 75% in 2030, compared to 2016. However, the plan does not set a specific sub-target for energy poverty under Energy Savings Obligation, while there is no concrete timetable to develop the specific measures announced.

The plan details some policies and measures addressing energy poverty. However, the description of the current situation on energy poverty is not very detailed and does not explore synergies with measures to develop demand response, accelerate building renovation and energy savings in a targeted manner to have direct effect on households on energy poverty and empower vulnerable consumers.

3.5 Research, innovation, competitiveness and skills dimension

3.5.1 Research and innovation

The draft updated NECP indicates that the priorities and policies for the research, innovation and competitiveness dimension are under revision and **will be included only in the final updated NECP**. Therefore, the Greek draft updated NECP does not include a dedicated chapter on the research, innovation, and competitiveness dimension. Greece neither reported on the national target and spending for research and innovation in specific clean energy technologies, nor made any reference to the **SET Plan**.

The draft updated NECP mentions **international cooperation in R&I** through a joint declaration between Greece, Cyprus, and Israel as well as Memorandum of Understanding between Greece, Cyprus and Jordan. However, no information is provided on the objectives pursued through these agreements or potential joint projects in the field of R&I. In the context of the bilateral scientific -and technological cooperation and agreements in force with other countries, the Secretariat-General for Research and Technology (GSRT) is launching joint calls for research and technology programmes. The calls announced concern the submission of proposals for the implementation of bilateral R&I projects in the field of energy.

The Plan reports that actions in the energy and climate change sector relating to R&I (e.g. actions involving -new, sophisticated energy storage systems, new materials, etc.), business -(e.g. measures for the energy upgrading of small and medium-sized enterprises) and ICT (e.g. incentives for digital businesses in the field of energy data, etc.) can be financed through the *A smarter Europe by promoting innovative and smart economic-success.*

3.5.2 Competitiveness

Industrial competitiveness is mentioned as a priority throughout the draft updated NECP. In its long-term strategy, the government supports a path towards a climate-neutral economy with a view to improving the competitiveness of the economy and businesses, creating new jobs, strengthening the role of the consumer and overall, the functioning of competitive energy markets.

Despite this support, the draft updated NECP does not describe specific measures and associated investment geared to scaling up manufacturing capacities for clean energy technologies, or to strengthening the resilience of supply chains for components and raw materials, with the exception of the studies that Greece is undertaking to determine how best to access and use the minerals present within its territories, both privately and publicly. The draft updated plan also does not include measures supporting the digitalisation of the energy system.

The document does refer to circularity throughout the document as a vector for competitiveness. It refers to the National Strategy for Smart Specialization 2021-2027 adopted in June 2022 that sets a policy framework for promoting R&I in the circular economy. In addition, circular economy is supported through targeted interventions e.g. via a single state aid action entitled 'Research-Creation-Innovator' 2021-2027.

Finally, the new Action Roadmap for Circular Economy approved in 2022 includes a multiannual funding plan for research infrastructures, illustrative of the country's interest in promoting long-term investments in large-scale- research infrastructures.

3.5.3 Skills

The draft updated NECP acknowledges the importance of ensuring skills development for the clean energy transition. However, it does not include information on skill gaps and measures and investments to overcome them to boost European competitiveness in clean energy technologies, equipment and components (skills developments required for the clean energy transition, connecting for instance with relevant European Year of Skills initiatives, Pact for Skills large scale partnerships, New Innovation Agenda).

4 JUST TRANSITION

Just transition aspects are addressed in the draft updated NECP in a very limited manner. The plan provides only limited qualitative and quantitative analysis of the social, employment and skills effects of the energy and climate transition, including distributional impacts, and does not elaborate on strategies to tackle these. Also, it does not provide sufficient information for the preparation of the Social Climate Plan, as assessed in Chapter 7.

While the plan refers to the objectives and measures set by the national development programme for a fair transition in the lignite regions of Western Macedonia and the Municipality of Megalopoli, it does not provide the necessary details on measures to minimise the negative impacts in these areas. Moreover, the draft updated plan provides contradictory and incomplete information compared with the Territorial Just Transition Plans (TJTPs), especially on the lignite fuelled power plants, making it unclear how this will impact the related planned measures. Also, there is little information on foreseen

measures and expected results for islands, and there is no reference to the GR-eco Island Initiative for the smaller and non-interconnected islands.

Overall, when mentioned, the measures to address access and preservation of employment, access to affordable and inclusive education, training and life-long learning are not detailed nor targeted, nor is it clear whether a fair tax-benefit and social protection systems for affordable access to essential services for all is ensured in the context of the climate and energy transition. Finally, while the plan refers to available financial tools, it does not detail the resources specifically devoted to supporting the fair transition.

5 REGIONAL COOPERATION

The draft updated plan generally addresses regional infrastructure development well. The Central and South-Eastern Europe Connectivity (CESEC) high level group[20] has established a regional action plan where Greece and involved neighbouring countries make best efforts to develop or facilitate the development of gas infrastructure projects. This includes the expansion of the Trans Adriatic Pipeline (TAP) and the Gas Interconnector Greece–Bulgaria (IGB) capacities as well as the construction of an interconnection with North Macedonia. The current status and expected impact of these projects in the region, particularly for security of supply, are not set out in detail, however.

Greece has still not signed any solidarity agreement for the security of gas supply with its neighbours, out of the two needed (with Italy and Bulgaria).

In the area of renewable energy, the draft updated NECP refers to a joint declaration between Greece, Cyprus and Israel which extends their cooperation in the field of renewables, alternative fuels, electric vehicles, the enhancement of innovation and the implementation of joint pilot projects. However, no concrete renewable energy joint projects are envisaged.

6 INTERNAL COHERENCE AND POLICY INTERACTIONS WITHIN THE DRAFT UPDATED NECP

From an initial review of the draft updated NECP, it appears that Greece acknowledges the importance of each of the targets of the Energy Union and aims to address each of them through national policies. Overall, there appears to be consistency in the objectives outlined throughout the plan, however, given the limited details provided, the updated plan would benefit from clearer specifications and/or quantifiable targets and objectives, to enable a more accurate assessment of the coherence between planned policies and objectives. Through an initial revision, some over-arching themes and objectives could be identified. In the transport sector, Greece has increased its electrification target of vehicles, and expanded the re-charging infrastructure. In this regard, there is a synergy between increased electrification and higher percentages of electricity from RES. The way how

[20] Four high level groups have been set up by the European Commission to provide strategic steering and policy guidance on regulatory and infrastructure development and to monitor progress of projects of common interest in priority regions. They include: The North Seas Energy Cooperation (NSEC); Interconnections for South-West Europe; Baltic Energy Market Interconnection Plan (BEMIP); Central and South Eastern Europe energy connectivity (CESEC).

policies and measures should exploit synergies across policy areas is not provided, even though at the beginning of the NECP it is explained that all policies and measures must be read through a holistic approach.

The dimension of research and innovation touches upon most other dimensions in the draft updated NECP, however, there is limited discussion of research targets and timelines. More specifically, in many sectors, research is identified as a key process and element for future developments, such as in the case of marine transport, water management, and LULUCF; however, no detailed research plans have yet been established. Overall, decarbonisation appears to be the most encompassing theme among the 5 dimensions, discussed in most sectors, and impacted by the broadest number of policies.

7 STRATEGIC ALIGNMENT WITH OTHER PLANNING INSTRUMENTS

Greece formally submitted a modified RRP and REPowerEU chapter on 31 August 2023, endorsed by Commission on 21st November 2023.

The draft updated NECP includes or refers to 44 out of the 84 climate relevant measures in the RRP (i.e., those with 40% - 11 measures - or 100% - 33 measures - climate tracking), covering 38 RRP investments. Examples of measures included in the NECP include the electricity interconnection of the Cyclades islands to the mainland electricity grid, and the support of the installation of storage systems to enhance RES penetration. Overall, 11 measures among those that are 100%-climate tagged are insufficiently or not at all reflected in the draft updated NECP, such as the preparation of the urban plans and investments related to interventions in residential areas and building stock (Athens Riviera). In addition, most measures that are reflected lack granularity and detail to allow for a full comparison with those in the RRP. Investments in energy efficiency renovations in residential and public buildings were briefly mentioned without further specifying the scope of application.

The draft updated plan is partially consistent with the **Territorial Just Transition Plans** (TJTPs) regarding timetable for the closure of lignite powered plants. Also, there are inconsistencies between the lignite fueled power plants included in TJTPs and those mentioned in the draft updated NECP.

The plan provides inadequate analytical basis for the preparation of the **Social Climate Plan (SCP)** that will address the impacts of the new emissions trading system for fuel combustion in buildings, road transport and additional sectors (ETS2) on vulnerable households, transport users and micro enterprises. The draft updated NECP contains a section dedicated to the Social Climate Fund (SCF), which presents only general information and does not outline concrete measures to be included in the future SCP. The plan contains no information on the governance of the Fund, on the process to draft the SCP, on the methodology to identify potential beneficiaries, or other information useful for the effective implementation of the SCF. The plan mentions the potential impacts of the ETS2 on vulnerable groups; however, measures are not planned for the identification of transport poverty, nor are reduction targets mentioned. Although the plan contains several measures that would be, in principle, eligible under the SCF, such as certain policy measures under the Action Plan for combatting energy poverty, no explicit link is made with the SCF. Thus, the current draft does not explain how the SCP will build on the NECP update and how the consistency between the two plans will be ensured.

In the draft updated plan, Greece does not provide the quantification of the climate impacts of measures currently included in the **CAP Strategic Plan** (CSP), thus the plan does not explain whether the CSP is in line with the new LULUCF and ESR targets and whether additional measures are necessary.

Compared to the **National Adaptation Strategy**, the plan is less detailed and less ambitious on the respective actions.

The draft updated NECP of Greece addresses the **2022 and 2023 country-specific-recommendations** to enhance diversification and reduce their dependency on fossil fuels by taking specific actions such as shortening and simplifying permitting procedures to accelerate the deployment of renewables, and stepping up measures that improve energy efficiency. Moreover, amongst others, the draft updated NECP includes actions to upgrade Greece's electricity transmission and distribution infrastructure to allow a higher roll out of renewables and measures promoting electricity storage systems and electromobility.

8 FINANCING THE ENERGY AND CLIMATE TRANSITIONS

8.1 Investment needs

The draft updated NECP includes quantitative information on the expected investment needs to implement the policies and measures, based on a Central (WEM) Scenario. The investment expenditures are provided for total investments as well as for some sectors and certain measures, such as electricity generation, distribution and transmission of electric energy, transport (purchase of vehicles and means of transport), residential (energy upgrading of buildings), residential (purchase of appliances and scraping), with estimates of increased investment needs of 2% of GDP up to 2030, decreasing to 1 percentage point afterwards. These costs are compensated by reducing operating costs across all sectors of energy consumption and production. The investment needs are not separated into public and private. They are provided as annual investments, averaged over five-year spans.

8.2 Funding sources

The plan outlines occasionally the main sources of financing used to implement the key policies and measures. However, this is not done on a per measure basis, but instead in the form of a brief description of the different funding programmes used by Greece. There is also no consolidated overview at plan level. It is therefore not possible to identify potential gaps in terms of funding. It is recommended to provide information on the sources of financing for each policy and measure in the final NECP, including information on the public and private part, the lifetime of the measure, the share coming from the EU budget or NextGenerationEU, explicitly. An overview table gathering all the budgetary information of the different policies and measures should also be provided.

9 ROBUSTNESS OF THE ANALYTICAL BASIS OF THE DRAFT UPDATED NECP

Overall, it is not possible to analyse the quality of the quantitative **analyses underpinning** the draft updated NECP because it does not provide any description of the analytical tools used for the preparation of the plan. The methodologies used for With Existing Measures

(WEM) projections and impact assessment of specific policies and measures are not clearly explained and referenced. It is not explained what model the analysis is based on and whether the parameters recommended by the Commission were applied; while the input parameters are given, the data sources are not provided. Based on this, it cannot be determined whether the projection is analytically sound.

The plan describes a so-called central scenario, without clearly stating whether this is a WEM or With Additional Measures (WAM) scenario. Based on one mentioning of a WEM scenario in the context of the LULUCF projections, it is assumed by the Commission that the central scenario refers to a WEM scenario. The projection includes information on the relevant sectors of the economy, including industry, the energy system and transport and covers the period until 2050. However, it does not provide an ETS/ESR split, which is essential to assess the likelihood for the draft updated plan to reach the ESR target of -22.7% in 2030 below 2005 levels. The new ETS for buildings, road transport and additional sectors (ETS 2) has not been considered in the plan nor in projection scenarios.

The draft updated NECPs contains a **macro-economic assessment**. However, the assessment is only qualitative and not developed enough. The plan identifies only some of the transmission channels, and while it presents a quantitative forecast for the GDP, investments and some other variables, it does not include a "no policy change scenario" and an impact assessment on GDP, its main demand components, and employment over time. Overall, the draft updated NECP lacks a comprehensive quantitative assessment of the macro-economic impact of the proposed policies and measures. The impact on the public budget is assessed to some extent and there is information on its financing, but it needs to be further detailed.

The **policies and measures** are in general described in sufficient detail in terms of their scope, but in almost all fields there is a lack of information in regard to timing and likely impact. Moreover, the descriptions are often limited to broad guidelines rather than specific policies. The new ETS for buildings, road transport and additional sectors (ETS 2) has not been considered in the plan nor in projection scenarios.