4 Climate change mitigation and adaptation

The recession and related drop in energy demand helped Greece's greenhouse gas emissions decline considerably over the past decade, putting the country on track to meet its international mitigation commitments. Greece recently increased its climate ambition for 2030 and developed a long-term vision to put the economy on a climate-neutral pathway. Being highly vulnerable to climate change, the country has laid the groundwork for stronger climate resilience, including through development of a national adaptation strategy. This chapter reviews progress and aims to identify remaining challenges regarding climate change mitigation and adaption.

4.1. Introduction

Greece's greenhouse gas (GHG) emissions have significantly declined over the past decade, mostly due to the recession and a shift towards cleaner energy. Thanks to this decrease, Greece met its Kyoto Protocol commitment and is on track to reach its 2020 and 2030 mitigation targets. However, the economy's GHG intensity has improved only moderately and remains one of the highest in the OECD, indicating that there is scope to increase climate action. Greece recently committed to phase out lignite by 2028. The government adopted ambitious targets for 2030 and developed a long-term vision for mitigation. However, additional measures will be needed to achieve climate neutrality by 2050.

Being highly vulnerable to climate change, Greece has developed a detailed model of its impact and strengthened the policy and institutional framework for adaptation. It has adopted a climate change adaptation law and strategy, required regional governments to develop their own action plans and established a national adaptation committee to co-ordinate policy design and evaluation, as well as a special scientific committee on climate change. The design and implementation of concrete adaptation action, however, is a work in progress. There is significant scope for better integrating adaptation considerations into sectoral policy and a need for capacity building and dissemination of good practice to ensure that the new framework results in resilience.

This chapter reviews progress and aims to identify remaining challenges regarding climate change mitigation and adaption. It discusses the policy and institutional framework for climate action and outlines the main measures to reduce emissions and increase resilience in relevant sectors.

4.2. State and trends of greenhouse gas emissions

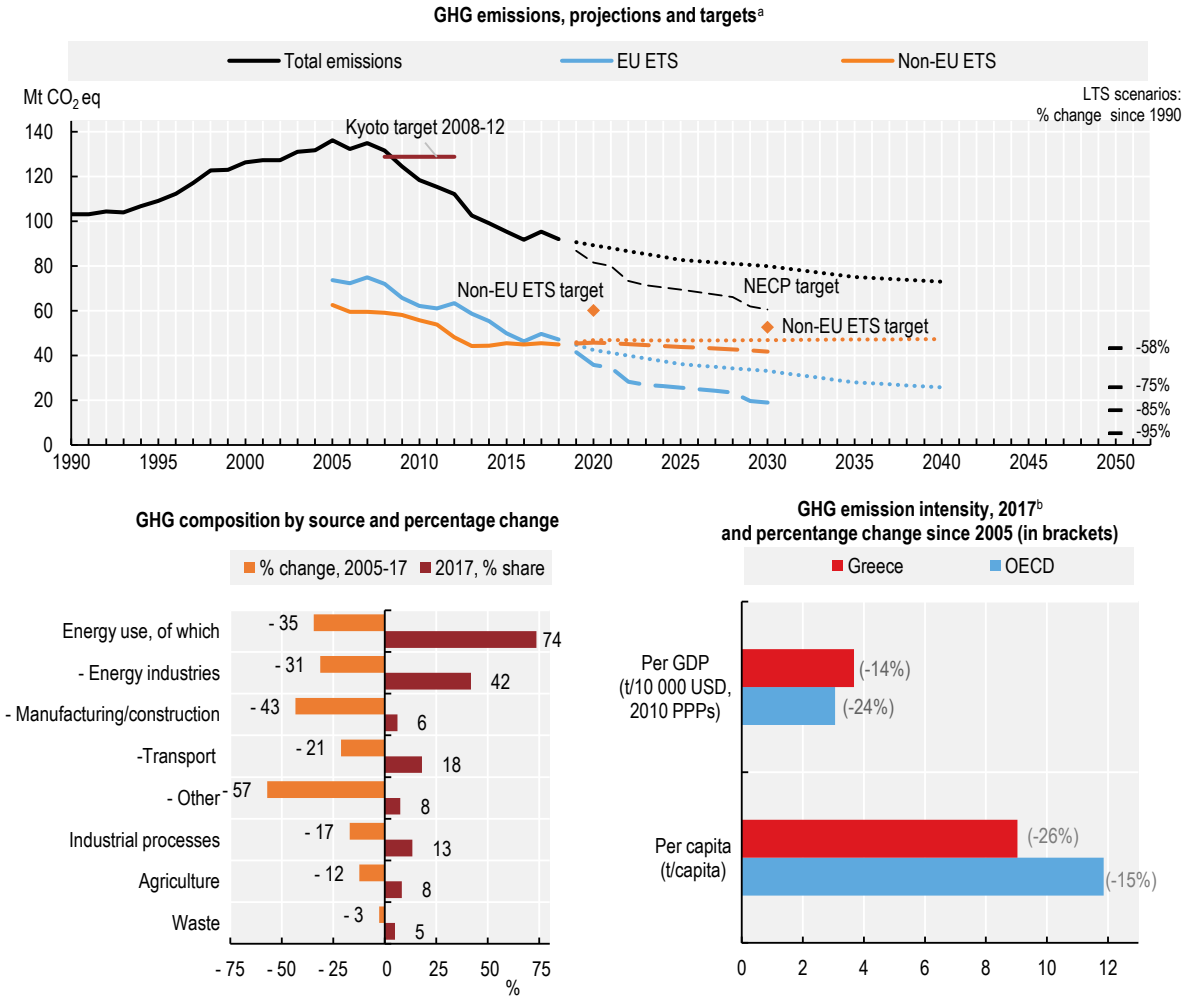
4.2.1. Emission profile

GHG emissions[1] peaked in 2005 and have since been decreasing. They reached 92 million tonnes of CO_2 equivalent (Mt CO_2eq) in 2018, down by 33% since 2005 and by 11% since 1990 (Figure 4.1). Greece achieved the second largest emission reduction among OECD countries over 2005-17. The decline was largely due to the financial and economic crisis, which depressed energy demand, although a shift from coal and oil towards natural gas and renewable energy sources in power generation also played a role.

As in most countries, energy use accounts for the majority of emissions (three-quarters in 2017), with industrial processes, agriculture and waste making up the remainder (Figure 4.1). While GHG emissions have declined in all sectors since 2005, the reduction was mostly driven by lower emissions from power generation and, to a lesser extent, from the residential, transport, manufacturing and construction sectors. Land use, land-use change and forestry (LULUCF) has been a small carbon sink over the past decade, with net removals oscillating around 3 Mt CO_2eq annually. CO_2 accounted for 78% of emissions in 2017, methane 10%, fluorinated gases 6% and nitrous oxide 5% (MoEE, 2019b).

Per capita emissions have steadily declined over the past decade and are significantly below the OECD average (Figure 4.1). Improvement in the economy's GHG intensity (GHG emissions per unit of GDP) was comparatively modest. Greece remains among the OECD's ten most carbon-intensive economies due to the prevalence of lignite for power generation and reliance on diesel on non-interconnected islands (Section 4.4.1).

Figure 4.1. GHG emissions have steeply declined, but the economy's carbon intensity remains high



a) GHG emissions excluding land use, land-use change and forestry. 2018: Preliminary data. Dotted lines refer to projections submitted under Art. 14 of the EU Monitoring Mechanism Regulation, with existing measures. Dashed lines refer to projections of the National Energy and Climate Plan (NECP). Non-ETS targets: Under the EU Effort Sharing legislation. 2050: Emission reductions in the Long-term Strategy scenarios (LTS). From top to bottom: Continuation of NECP measures after 2030; acceleration of NECP measures after 2030; with additional measures in a 2° scenario; with additional measures in a 1.5° scenario.
b) Emissions expressed in tonnes of CO_2 eq.
Source: EEA (2019), *Country Profiles: Greenhouse Gases and Energy 2019* (database); MoEE (2019), Climate Change Emissions Inventory: Submission of the Information under the Articles 12, 13 and 14 of the Monitoring Mechanism Regulation (EU) 525/2013; MoEE (2019), *National Energy and Climate Plan*; MoEE (2020), *Long-term Strategy to 2050*; OECD (2019), "Air and climate: Greenhouse gas emissions by source", *OECD Environment Statistics* (database).

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4.2.2. Progress on international commitments

Greece surpassed its target for the first Kyoto Protocol commitment period of limiting the increase of GHG emissions (excluding those from LULUCF) to 25%, achieving a 17% rise over 2008-12 from 1990 levels (Figure 4.1). It is also on track to meet the 2020 and 2030 targets set by European Union (EU) regulations for emissions not covered by the EU Emissions Trading System (EU ETS).[2] By 2018, non-EU ETS emissions stood 28% below 2005 levels, far exceeding the target to reduce them by 4% over 2005-20 and by 16% over 2005-30. National projections indicate non-EU ETS emissions will be 25% below 2005 levels in 2020 and remain stable until 2030 if existing measures are continued (MoEE, 2019c). In other words, Greece will overachieve its 2020 target by 21 percentage points and its 2030 target by 9 percentage points.

In December 2019, the government endorsed the National Energy and Climate Plan (NECP), which reflects its commitment to phase out lignite by 2028 and includes ambitious energy and climate targets for 2030 (Section 4.3.2) (MoEE, 2019a). Greece should be commended for increasing its ambition, in line with the Paris Agreement. The NECP envisages emissions declining primarily due to decreases from power generation, and emissions in non-EU ETS sectors falling slightly from today's level (Figure 4.1). Nevertheless, if the country achieves its 2030 goals, additional measures will need to be implemented to achieve carbon neutrality by 2050. Continuation of NECP measures beyond 2030 would reduce total GHG emissions by 58% from 1990 levels by 2050 (MoEE, 2020).

NECP implementation is expected to reduce non-EU ETS emissions by 36% over 2005-30 (MoEE, 2019a). Residential energy efficiency measures will contribute the most to non-EU ETS emission reductions over 2020-30 (-9%). Transport emissions are expected to decline only moderately. The NECP does not detail emission projections in the agricultural and waste sectors but non-CO_2 emissions, which mainly come from these sectors, are expected to fall marginally. LULUCF is projected to remain a net sink, although a reduced one.

4.3. Institutional and policy framework for mitigation

4.3.1. Institutional arrangements

The Ministry of Environment and Energy (MoEE) is responsible for national climate change mitigation and adaptation activities. It co-ordinates all relevant institutions regarding implementation of climate change commitments and bears overall responsibility for monitoring national action and the national GHG inventory. The establishment of the MoEE in 2009[3] raised the profile of climate change policy and enhanced integration of energy, climate and air policies, in line with a recommendation of the 2009 Environmental Performance Review (OECD, 2010). Nevertheless, as in many countries, mitigation policy is fragmented across institutions, with line ministries being responsible for implementing climate change policy within their respective fields.

Inter-ministerial committees and working groups bring together relevant ministries and stakeholders. There are, for example, committees on the GHG emission inventory, national energy planning and climate change adaptation. The climate change adaptation committee has only convened once since it was established in 2016, limiting its capacity to execute its mandate (Section 4.6.1).

Subnational authorities are responsible for some infrastructure and services relevant to climate change in areas such as public transport, implementation of infrastructure projects and integration of renewables projects into regional development plans. More than 100 of the 332 municipalities have submitted climate change action plans and GHG emission targets under Mayors for Climate and Energy (Covenant of Mayors, 2019). About one-third of the plans contain targets and actions for adaptation. Athens was the first Greek city to join the C40 and C100 networks[4] and to develop an integrated climate action plan for both mitigation and adaptation (Box 4.1). Its experience will provide valuable lessons for other cities. The establishment of municipal networks and partnerships could facilitate exchange of experience and best practice.

Box 4.1. Athens's climate action plan is an example to other cities

Athens is a leader on climate action. It adopted a climate action plan, with mitigation and adaptation measures, in 2017 thanks to its work in the C40 Cities Climate Leadership Group. It also developed the Athens Resilience Strategy for 2030, an overarching vision for its development. The strategy has four pillars: open city, green city, proactive city and vibrant city.

The climate action plan for mitigation set a goal to reduce GHG emissions by 40% by 2030, compared to 2014, mainly by improving energy performance of buildings and public lighting, installing renewables in public buildings and improving local transport services.

The climate action plan for adaptation focuses on addressing heat waves, whose intensity has worsened. The plan aims to enhance green infrastructure (e.g. making public spaces greener and establishing green corridors) and the built environment (e.g. using sustainable materials and bioclimatic design) and to protect public health and vulnerable groups, including through public information campaigns. For example, the city launched a smartphone app, in collaboration with the National Observatory of Athens, allowing citizens to assess their risk during heat waves and get information about nearby cool spots.

The European Investment Bank is providing a EUR 55 million loan, complemented by technical assistance, to support implementation of Athens's resilience strategy. The support will help, for example, in integrating energy efficiency measures into renovation of historic buildings and schools, integrating green infrastructure components into renovations and the redesign of public spaces, greening streets and public places to reduce urban heat island effects, increasing water infiltration, improving air quality and creating green corridors to improve habitats of city flora and fauna.

Source: City of Athens (2017); EIB (2018).

4.3.2. The policy framework

Greece ratified the Kyoto Protocol in 2002 and the Paris Agreement in 2016. It adopted the Second National Climate Change Programme 2000-10 in 2002 (and amended it in 2007) to achieve the target of Kyoto's first commitment period (2008-12). It has had no comparable overarching, economy-wide strategy for the second commitment period (2013-20). Greece has adopted an NECP that outlines an evolution scenario for the energy system and proposes policies and measures for achieving the national energy and climate targets for 2030. Published in January 2019, it was revised in November to reflect increased ambitions of the new government, and endorsed in December after adjustments following public comments.

By 2030, the NECP aims to i) reduce total GHG emissions, excluding those from LULUCF, by 56% from 2005 levels (42% from 1990 levels); ii) reduce non-EU ETS emissions by 36% from 2005 levels, more than twice the reduction required by EU legislation;[5] iii) raise the share of renewables in gross final energy consumption to at least 35%; and iv) limit final energy consumption to 16.5 million tonnes of oil equivalent (Mtoe). While Greece has an overall emission reduction target for non-EU ETS sectors, no specific mitigation targets exist for individual non-EU ETS sectors.

Greece, like most EU countries, supports a carbon neutrality objective for 2050. It has not yet defined a 2050 mitigation goal, but has developed a Long-term Strategy to 2050 including decarbonisation scenarios (MoEE, 2020) (Figure 4.1). The strategy reviews possible evolution of the energy system but lists no specific measures. Its baseline scenario assumes that the 2030 NECP targets are met and that measures on energy efficiency and renewables are accelerated after 2030. The strategy explores options addressing the ambition to keep the temperature rise well below 2°C and pursuing efforts to achieve a 1.5°C rise.

Under each assumption, it envisages two scenarios, driven by high electrification or by partly switching to hydrogen and e-fuels. Greece should specify options to enhance the LULUCF sink to achieve its long-term goal of carbon neutrality.

Greece's climate mitigation targets are largely shaped by EU targets and legislation. Under EU effort sharing, Greece is expected to reduce non-EU ETS emissions by 4% by 2020 and by 16% by 2030, compared to 2005 levels. Under the EU 2020 Climate and Energy Package, it committed to renewables targets of 18% for gross final energy consumption and 10% for biofuels in transport energy consumption, and a limit on final energy consumption to 18.4 Mtoe by 2020. Several policy documents confirm or strengthen these targets and lay out policies on how to achieve them. The documents include the NECP, the National Renewable Energy Action Plan (NREAP) and the National Energy Efficiency Action Plans, discussed in more detail in the following sections.

4.3.3. Monitoring progress

The national monitoring and evaluation framework for mitigation is largely based on the EU requirements concerning GHG inventories, the Energy Efficiency Directive and the Renewable Energy Directive. As mentioned above, the MoEE is responsible for the GHG inventory and an inter-ministerial technical working group has been established to ensure quality and timely collection of activity data and to solve data access restriction problems that arise due to confidentiality issues. Preparation of the national GHG inventory has been assigned to National Technical University of Athens, except for the LULUCF inventory, which is prepared by an independent consultant. Annual GHG emission monitoring is consistent with the reporting requirements and guidelines of the EU and the UN Framework Convention on Climate Change.

MoEE teams monitor climate mitigation targets, but there is no overall review of climate policy implementation and effectiveness. Such review could be useful, as Greece has no mitigation targets for specific sectors and limited analysis of expected emission reductions from policies outside the energy sector (especially for non-EU ETS sectors). This makes it challenging to ensure accountability with respect to progress in these sectors. The European Commission has noted that Greece's NECP would benefit from more detailed analysis on how individual measures are modifying long-term GHG trends, especially measures affecting non-EU ETS emissions (EC, 2019a). Preparation of regular progress reports, as in the UK, could strengthen oversight on climate change integration into sector policies (i.e. beyond energy policy), track progress on policy implementation and assess how specific measures are contributing to the 2030 target.

4.4. Key policies and measures for mitigation

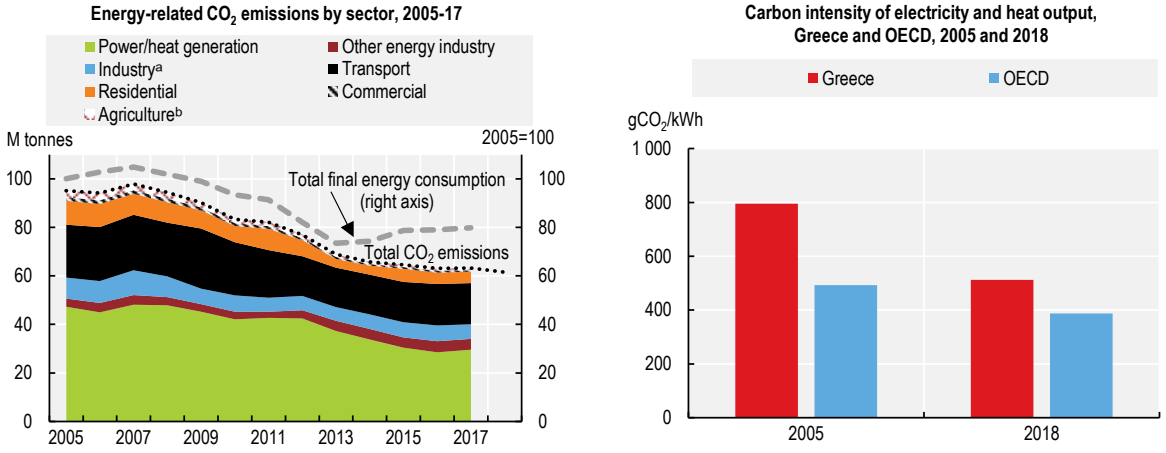
4.4.1. Reducing GHG emissions in the energy sector

Energy use accounts for three-quarters of GHG emissions, the bulk of which is CO_2 emissions. Energy-related CO_2 emissions declined by 35% between 2007 (when energy use peaked) and 2017, while total final consumption decreased by 24% (Figure 4.2). Emissions declined due not only to the economic crisis and associated drop in energy demand, but also to a shift in the fuel mix.

About half of energy-related CO_2 emissions stem from electricity and heat generation (Figure 4.2). These emissions fell by 37% over 2005-17 due to the financial crisis and a shift from lignite and oil to natural gas and renewables. The share of renewables in electricity generation rose from 11% to 31% over 2005-18 while that of lignite decreased from 60% to 34%. (IEA, 2019a). The shift has improved the CO_2 intensity of power generation, although it remains above the OECD average (Figure 4.2). Emissions from transport, the second-largest emitting sector, decreased by 22% over 2005-17 because fuel consumption declined. Emissions from the industrial, residential and commercial sectors also declined sharply, again largely due

to the economic slowdown and switch from oil to natural gas. Emissions from other energy industry increased by 36% because of rising emissions from refineries.

Figure 4.2. Energy-related emissions fell due to lower energy demand and growth in renewables



a) Manufacturing industry and construction.
b) Includes forestry, fisheries and other energy use.
Source: IEA (2019), *IEA CO_2 Emissions From Fuel Combustion* (database).

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The NECP aims at diversifying the energy mix and reducing CO_2 intensity while increasing energy security and making the energy sector more competitive (Table 4.1).

Table 4.1. The NECP calls for an ambitious shift towards cleaner electricity

Planned installed electricity generating capacity by source, 2020-30 (GW)

Energy source	2020	2022	2025	2027	2030
Coal	3.9	2.9	0.7	0.7	0.0
Oil	1.9	1.7	1.0	1.0	0.3
Natural gas	5.2	6	6.9	6.9	6.9
Biofuels	0.1	0.1	0.1	0.2	0.3
Hydro	3.4	3.7	3.8	3.9	3.9
Wind	3.6	4.2	5.2	6.0	7.0
Solar photovoltaics	3.0	3.9	5.3	6.3	7.7
Solar thermal plants	0.0	0.0	0.1	0.1	0.1
Geothermal	0.0	0.0	0.0	0.0	0.1
Total	21.1	22.6	23.1	24.9	26.2
Storage systems	0.7	0.7	1.4	1.4	1.4

Source: MoEE (2019a), *National Energy and Climate Plan*, December.

Most emission reductions are expected to be achieved through decommissioning of lignite-fuelled power plants, promotion of renewables and natural gas in all sectors and interconnection of islands with the mainland grid (Table 4.2). The transport sector's contribution to emission reductions is expected to be relatively small and achieved mostly through increased use of biofuels. The largest impact on non-EU ETS emissions is expected to come from energy efficiency in the residential and commercial sectors, reduction of fluorinated gas emissions and recovery of organic waste and biogas.

Table 4.2. Most GHG emission reductions are expected to come from the shift to renewables

Contribution of planned measures on GHG emission reductions

kt CO_2 eq/year

Measure	2020	2025	2030
Promoting the use of renewables in power generation	15 000	19 000	25 000
Improving the conventional power generation system*	11 700	8 200	5 500
Energy efficiency measures in the residential and tertiary sectors	2 930	3 500	4 000
Transport (increase in natural gas, biofuels, road transport measures)	1 007	1 330	1 582
Reduction of fluorinated gas emissions	460	1 400	2 300
Recovery of organic waste and biogas	1 300	1 500	1 700
Promotion of natural gas in industry	671	861	1 094

* Includes decommissioning of old thermal power units, commissioning of more efficient plants, increase of natural gas in electricity production and interconnection of islands with the mainland grid.
Source: MoEE (2019a), *National Energy and Climate Plan*, December.

Promoting renewables

Greece has considerable potential for renewables use due to its wind, solar, geothermal and biomass resources (IEA, 2017). The 2010 NREAP aims to reach a 20% share of renewables in gross final energy consumption by 2020, above the 18% EU target. It also sets sectoral targets, i.e. to raise the shares of renewables to at least 20% in heating and cooling, 40% in electricity consumption and 10% in transport. The NCEP sets 2030 targets of at least 61% renewables for electricity, 43% for heating and cooling and 19% for transport, more ambitious than the first version of the plan (Table 4.3). With existing measures (i.e. without NECP planned policies and measures), the respective shares would be 48%, 29% and 10% by 2030, meaning a 25% share of renewables in gross final energy consumption (MoEE, 2019c). Greece has reached the target for gross final energy consumption imposed by the EU directive for 2020. It has achieved the target for renewables-based heating and cooling, but is unlikely to meet the 2020 targets for electricity and transport.

Table 4.3. Greece has reached its 2020 binding target on renewables

Progress made towards the renewables targets

Sector	2018	2020 targets	2030 targets
Gross final energy consumption	18.0%	18%/20%	35% (31%)
Gross final electricity consumption	26.0%	40%	61% (56%)
Heating and cooling	30.2%	20%	43% (32%)
Transport	3.8%	10%	19% (20%)

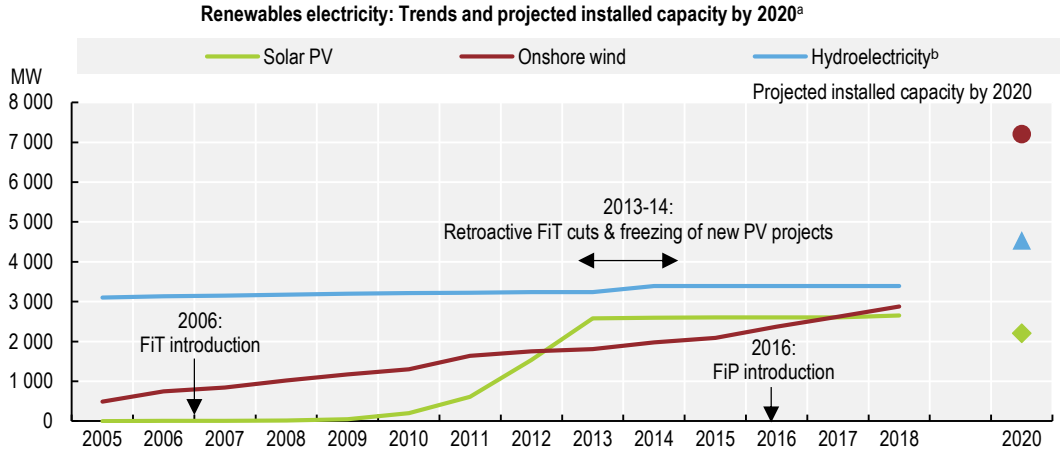
Note: The 2010 NREAP aims to reach a 20% share of renewables in gross final energy consumption by 2020, above the objective of 18% imposed by the EU directive (2009/28/EC). 2030: targets set in the final version of the NECP (in brackets are those of the first version for comparison).
Source: Eurostat (2020), *Share of Energy from Renewable Sources*; MoEE (2019a), *National Energy and Climate Plan*, December; MoEE (2010), *National Renewable Energy Action Plan in the Scope of Directive 2009/28/EC*.

Solar and wind power generation capacity has grown significantly, driven by generous feed-in tariffs (FiTs), lower technology costs and simplified licensing and permitting (Figure 4.3). Unlike solar photovoltaic (PV), wind capacity has developed more slowly than expected in the 2010 NREAP.

Due to a growing budget deficit associated with FiTs, especially for solar PV (payments to renewable energy producers peaked at EUR 2 billion in 2013, of which EUR 1.5 billion was for solar PV), licensing of

new solar PV installations was suspended and the FiT for solar PV was reduced in 2012-13. A solidarity contribution was imposed on renewables producers in 2012-14 (MoEE, 2016a). These measures stopped new PV installations (Figure 4.3). Compensation prices for technology were retroactively cut in 2014. The FiT programme was closed on 31 December 2015.

Figure 4.3. Solar and wind power generation capacity has grown significantly



Note: FiP = feed-in premium; FiT = feed-in tariff.
a) Installed capacity projected in the 2010 National Renewable Energy Action Plan.
b) Includes pumped hydro.
Source: IRENA (2019), *Renewable Energy Statistics 2019* (database).

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Since August 2016, Greece has applied a new renewables support programme based on feed-in-premiums (FiPs): providers receive a sliding premium on top of the market price of their electricity production. Since 2018, the aid has been granted to PV and wind installations that successfully participated in competitive bidding processes. FiPs are more market-oriented than FiTs and should help bring down costs of public support of renewables electricity generation. In 2018, when competitive bidding procedures were first applied, a total of 500 MW in wind and solar capacity was awarded. FiTs continue to be offered to small units (wind plants with capacity below 3 MW, other renewables plants of below 500 kW) and demonstration projects. FiTs also apply to projects on islands not connected to the mainland grid. FiPs and auctions are considered the most important policy measures supporting renewables through 2030. However, there is no auction roadmap in the NECP.

There is potential for electricity generation from other renewables, including geothermal, biomass and concentrated solar power, and for the use of renewables in sectors other than electricity generation (e.g. industrial heat and transport) (IEA, 2017). The NECP expects biomass use in renewables electricity to increase from 2% in 2020 to 4% by 2030, while geothermal and concentrated solar remain marginal. The NECP puts particular emphasis on promoting energy communities through which citizens and/or local authorities own or participate in the production and/or use of renewables, as well as net metering, which offsets electricity costs for customers who generate their own power (Box 4.2).

Greece has 29 non-interconnected electrical systems on islands, which rely to a large degree on expensive and polluting diesel generators. Most high-potential renewable energy sources are located on or near islands (IEA, 2017). However, there are integration challenges related to lack of storage and high fluctuations of electricity consumption with seasonal tourism. Connecting islands with the mainland grid to further exploit their wind and solar potential is a government priority. This will help reduce dependence on diesel while increasing islands' balancing ability as part of a larger integrated power capacity pool. Connection of the northern Cyclades is planned over 2018-20, Crete over 2020-23, the southern and

western Cyclades by 2025, the Dodecanese by 2028 and the North Aegean islands by 2029 (MoEE, 2019a). Greece also plans to strengthen regional interconnections, which can provide additional balancing capability. Investment in renewables-based electricity generation, combined with energy storage technology, is planned on islands where interconnection is not cost-effective.

Other government priorities include implementing the new electricity market model[6] to facilitate participation of renewables, improving the licensing system and revising the Spatial Planning Framework for renewables. While the government is taking steps to simplify and speed up licensing procedures, there are concerns about the impact of rapid wind development on biodiversity (Chapter 5).

Box 4.2. Energy communities: Strengthening the role of citizens in the energy sector

Energy communities, introduced by Law 4513/2018, encourage decentralised renewables-based power generation. The role of citizens and local actors in the energy sector is strengthened, promoting social economy and innovation. The law essentially enables local actors to participate in the production, distribution and supply of renewables-based energy, giving electricity consumers the possibility of becoming electricity producers. The law creates a favourable framework for development of renewables, offering economic and tax incentives.

An energy community has the legal form of a civil law partnership of exclusive purpose, the partners being citizens, local authorities and/or small and medium-sized enterprises. By establishing an energy community, the partners can develop renewables and combined heat and power projects and sell or consume the energy generated. The law regulates energy communities as non-profit organisations, although they may be profitable under specific and strict requirements. At least 51% of the members should relate to the place where the energy community is established (i.e. should reside or own property in the locality).

The law allows for “virtual power sharing investments”, meaning projects can be developed in spaces that are physically located away from the point of consumption (e.g. a roof of another building, or available land within the same prefecture). This allows citizens living in apartment buildings (where space for micro-generation installations is lacking) to engage in renewables-based energy production.

Source: Interreg Europe (2019).

Decreasing reliance on lignite

Lignite, the only significant domestic fuel, accounted for 30% of CO_2 emissions from fuel combustion and 67% from power generation in 2017 (IEA, 2019b). While the shares have declined over time, the transition to a low-carbon energy system requires phasing out lignite, which the new government has committed to do by 2028.

The NECP envisages continuing to partly replace lignite with natural gas. The government plans to position Greece as a gas hub for the southeastern European market and has taken steps towards liberalising and improving gas market efficiency. Projects are under way to expand the gas network to new cities and industries. The IEA has warned that these projects’ financial and economic viability needs assessment in a broader European context to avoid overcapacity that would go against consumer interests (IEA, 2017). Since the introduction of natural gas in the late 1990s, its share in total primary energy supply has increased steadily, reaching 18% in 2017.

Stricter emission standards imposed by the EU Industrial Emissions Directive and increasing CO_2 prices in the EU ETS render lignite-fuelled power generation increasingly expensive and uncompetitive. The mostly state-owned Public Power Corporation (PPC) decommissioned 0.9 GW of lignite capacity over 2010-16 and plans to decommission a further 3.9 GW (i.e. all currently operating plants) over 2019-23

(MoEE, 2019a). Ptolemaida V (0.7 GW), under construction, will be the only lignite power plant in operation beyond this date. Adjustments allowing it to burn other fuels by 2028 are being studied (energypress, 2019).

The cost-effectiveness of building lignite-fired plants is debatable, given stricter standards and rising CO_2 prices. The European Commission obliged the PPC to divest 40% of its lignite assets as part of the economic adjustment programme. However, the deadline to submit bids has been repeatedly postponed due to investor reluctance to buy assets that may run at a loss (Reuters, 2019). The authorities are preparing alternative antitrust remedies aimed at granting the PPC's competitors access to lignite-based generation until the full phase-out (EC, 2019b).

Reducing lignite mining and power generation has a social dimension, heavily affecting growth and employment in lignite-producing areas, notably Western Macedonia. The region, Greece's main lignite producer, accounts for about 80% of production and is the site of four lignite plants. The PPC is the region's largest employer (Wehnert et al., 2018). Greece is developing and engaging in initiatives to support a fair transition to a low-carbon economy, including at EU level (Box 4.3). A 2016 study produced scenarios of how various economic activities could balance the loss of jobs and income due to lignite plant closure. It found that if EUR 2.3 billion were invested in the region, the negative effects on employment and GDP could be countered (Prodromou and Mantzaris, 2016).

Box 4.3. Supporting the low-carbon-economy transition in lignite-dependent regions

In 2018, Greece established a Fair Transition Fund to devote 6% of the revenue from auctioning EU ETS allowances (around EUR 20 million per year) to diversify local economies and create new jobs in lignite-dependent regions. The fund is expected to finance low-carbon and low-environmental-footprint projects in the Florina and Kozani regional units and in the Megalopolis municipality. In addition, the PPC has funded environment and development projects worth around EUR 130 million in these regions since 2014.

Greece is a member of the EU Coal Regions in Transition initiative, launched in 2017 to build capacity through technical assistance for development of inclusive transition strategies and roadmaps, provide support material such as toolkits and reports, and connect stakeholders in coal regions in transition. Western Macedonia was selected as a pilot region, along with Silesia in Poland and Trenčín in Slovakia. Greece expects to benefit from the recently launched EU Just Transition Mechanism, which aims to mobilise at least EUR 100 billion over 2021-27 to support the regions and sectors most affected by the transition towards the green economy. An inter-ministerial committee is preparing a comprehensive Just Transition Plan that will allow the country to get access to related EU funding.

Source: MoEE (2019a); WWF (2019).

Transport

GHG emissions from transport declined 21% between 2005 and 2017. Transport is the second-largest GHG emitter, accounting for 18% of total GHG emissions in 2017 (MoEE, 2019b). As in most countries, the majority of transport emissions stem from road transport (86% of total transport-related emissions in 2017), although the share of domestic navigation is also rather high (11%) (Figure 4.4). Transport emissions declined sharply over 2009-12 due to reduced road transport consumption (from both passenger cars and trucks), but have been increasing since.

Figure 4.4. Transport emissions fell during the crisis, but are on the rise again

Source: UNFCCC (2019), *Greenhouse Gas Inventory Data* (database).

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The NECP includes projections but no overall target for reducing transport-related CO_2 emissions. It establishes or confirms targets on specific issues (e.g. the share of renewables in the sector's energy use, the share of electric vehicles). The National Transport Plan, published in June 2019, expects annual GHG emissions to be reduced by 0.3 Mt CO_2 eq by 2037, which is equivalent to 2% of the sector's emissions in 2017. However, it lacks detailed quantified information on policies and measures to deliver the reductions.

The NECP continues the focus of current transport policies, concentrating on promoting alternative fuels (biofuels and natural gas in public transport) via tax incentives. It also calls for electrification of road and rail and promotion of public transport. Greece has put in place measures to replace old cars, taxis and motorcycles and made transport taxation more environment-friendly; for example, the vehicle registration tax is now linked to CO_2 emissions and the Euro emission standards, and hybrid cars and electric vehicles benefit from tax reductions and exemptions (Chapter 3). The mitigation potential of fuel switching and road transport measures is estimated at the equivalent of 6% of the sector's 2017 emissions by 2020, and 9% by 2030 (Table 4.2). NECP projections show transport-related emissions being expected to decline by 5% by 2030.

The goal of raising the share of electric passenger cars to 30% of new registrations by 2030 is challenging, as the electric vehicle market is in its infancy. Electric vehicles accounted for 0.3% of new cars sold in 2019, one of the lowest shares in Europe (MoEE, 2019a; ICCT, 2018). In a context of limited vehicle sales since the economic crisis, it will be important to monitor the effectiveness of incentives and address non-fiscal barriers, such as the lack of support infrastructure and limited knowledge about the advantages of electric vehicles and of eco-mobility more generally. An Inter-ministerial Committee has been mandated to develop an operational electro-mobility development plan by 2020.

Biofuels account for a small share of energy used in transport (Table 4.3). Greece has a mandatory target for blending biodiesel into diesel of 7% (by volume) and recently established an obligation for blending bioethanol into petrol at 1% (of energy content) in 2019 and 3.3% in 2020. While most biofuels are first-generation biodiesels produced from raw materials such as oil seeds (mainly sunflower and cottonseed), along with used cooking oil, a 2018 law set a 7% limit on the energy content of biofuels and bioliquids produced from raw materials that are used as food or feed, which can be taken into account in relation to national renewables targets. There is also a target of a 0.2% share of advanced biofuels in the energy content of vehicle fuels. Greece has updated its regulations to align its national certification with other EU countries. All biofuel producers and traders are now certified through a voluntary programme (MoEE, 2018a).

Regarding shipping, the NECP mentions cold ironing (supplying electricity to berthed ships so they can turn off their engines) as a way to reduce GHG and air pollutant emissions, as well as vibration and noise.

The port of Killini in Western Greece offers the first shore-to-ship electrical supply connection in the eastern Mediterranean (Chapter 1). Additional GHG emission reductions could be achieved through energy-saving technology and operational changes to the fleet.

Reducing energy demand in the industrial, residential and commercial sectors

Energy use dropped considerably during the economic crisis, but has been increasing since 2013. Transport accounts for the highest share (35%) of final energy consumption, followed by the residential sector (26%) and industry (19%). Energy intensity (energy supply per unit of GDP) has decreased more slowly than in most other OECD countries and is slightly below the OECD average (Chapter 1).

In line with the EU Energy Efficiency Directive (EED), Greece's third Energy Efficiency Action Plan (2014) aims to limit final energy consumption to 18.4 Mtoe by 2020, and the NECP envisages maximum consumption of 16.5 Mtoe in 2030. While Greece is on track to meet its 2020 target (with final consumption at 16.8 Mtoe in 2017), the 2030 target seems to require limited additional saving (-1.8%) from the 2017 consumption level.

Several energy efficiency policies have been introduced since 2005, many of which transpose requirements from the EED into Greek law. They include an obligation for large industry to either conduct an energy audit every four years or adopt an energy or environmental management system in 2016 and an energy efficiency obligation programme in 2017. Many of the measures, however, have not delivered energy savings as hoped due to the financial and economic crisis, low public awareness, insufficient data and lack of funding (IEA, 2017). The NECP lists several energy efficiency measures, many of which were included in the fourth Energy Efficiency Action Plan (2017) but have not yet been implemented. Particular attention should be paid to improvement in the service and transport sectors, which are expected to be the main sources of increase in energy demand to 2030 (MoEE, 2019c).

The energy efficiency obligation programme requires electricity, gas and oil product providers with a certain market share to make savings by 2020 in line with annual targets. Despite its short time frame (2017-20) and a focus on soft measures (behavioural actions and information campaigns) for the first period, it is expected that the programme will provide about 10% of the energy savings required by the EED by 2020. Obligated parties must submit action plans for review to the Centre for Renewable Energy Sources and Energy Savings. This requirement's aim is to make up for obligated parties' relative lack of experience with energy efficiency programmes and the absence of national public campaigns (ATEE, 2017). Energy audits and active involvement of energy service companies can help build capacity among participating parties.

The EED requires Greece to renovate at least 3% of the total floor area of public buildings per year. In addition, every new public sector building must be nearly zero-energy from 2019. The 2018 long-term building renovation strategy aims to improve the energy performance of at least 7% of the current building stock by 2030 (MoEE, 2018b). The NECP proposes raising the share to between 12% and 15%, which corresponds to 60 000 buildings renovated annually until 2030. Improved energy efficiency of buildings is expected to increase domestic value added by EUR 8.1 billion and create more than 22 000 full-time jobs. The renovation strategy will have to be strengthened to decarbonise the building stock by 2050, as required by the revised EU Energy Performance of Buildings Directive (2018/844/EU).

4.4.2. Mitigation in agriculture and forestry

Agricultural emissions accounted for 9% of total net GHG emissions in 2017, having declined by 12% since 2005. Most emissions stem from enteric fermentation and agricultural soil. The LULUCF sector has been a net sink for the past two decades, sequestering about 2% of total emissions in forests and grasslands, which more than offset the relatively low level of emissions from land-use change and wood product harvesting (MoEE, 2019b).

The NECP mentions measures addressing emissions from land use, agriculture and forestry. However, as with other non-EU ETS sectors, it does not provide quantified mitigation (or sequestration) targets or indicate how Greece plans to achieve its commitment to ensure that LULUCF emissions do not exceed removals.[7] Reductions in agriculture and LULUCF are expected to be achieved through the greening component of the EU Common Agricultural Policy[8] and the Rural Development Programme 2014-20, which includes two large components (in budgetary terms) on organic farming, at EUR 741 million, along with promotion of agri-environmental and climate measures at EUR 452 million (MoEE, 2019c). Other

measures aim at decreasing synthetic nitrogen fertiliser use, disengaging agricultural subsidies from production, encouraging environment-friendly livestock farming and better animal waste management and soil management, and promoting carbon sequestration through protection and gradual increase of forest land and improvement of degraded forest land. The carbon sequestration potential of LULUCF is expected to decline, even though the 2018 National Strategy for Forest (Chapter 5) aims to enhance sequestration.

4.4.3. Cross -sectoral mitigation measures

While Greece does not have a carbon tax, it has expanded energy excise taxes over the review period, which put a relatively high implicit price on CO_2 emissions from energy use. However, this implicit prices varies considerably across users and fuels, providing unequal abatement incentives (Chapter 3). About 140 installations are covered under the EU ETS. The third trading period (2013-20) reduced the supply of allowances (which had been allocated for free in the first two trading periods), and increased their cost, particularly for the carbon-intense lignite power generation units (Chapter 3). Revenue from auctioning of emission allowances amounted to EUR 820 million over 2013-17, most of which was used to support renewables.

Phasing out fossil-fuel support would accelerate the shift towards renewables. In 2016, fossil fuel support accounted for more than one-quarter of energy tax revenue, among the highest shares in the OECD. In addition to favourable tax treatment for fossil fuels used in various sectors, Greece supports fossil fuel power generators through budgetary transfers, locking in carbon-intensive capital assets and increasing the risk of stranded assets (Chapter 3).

4.5. Current and projected climate change effects

As a Mediterranean country with thousands of islands, Greece is highly vulnerable to the impact of climate change (Barros, 2014). It is prone to extreme climate events and regularly experiences heat waves, droughts, floods and forest fires (Figure 4.5). Decreasing precipitation and rising mean temperatures are already affecting the economy and ecosystems. Large areas were burned, buildings were destroyed and many people died (Bank of Greece, 2011). Fires in 2018 caused even more deaths. Although total burned area has decreased in the past decade, wildfire risk is projected to increase in southern Europe (Barros, 2014).

Figure 4.5. Forest fires caused many deaths in 2007 and 2018

Note: Forest fire data are based on MODIS satellite imagery at 250 m ground spatial resolution. Data refer to total burned areas larger than 40 ha (approximately 75-80% of total area burned).
Source: CRED (2019), *Emergency Events EM-DAT* (database); EU (2019), *Copernicus Emergency Management System* (database); San-Miguel-Ayanz et al. (2019), *Advanced EFFIS Report on Forest Fires in Europe, Middle East and North Africa 2018*; San-Miguel-Ayanz et al. (2018), *Forest Fires in Europe, Middle East and North Africa 2017*.

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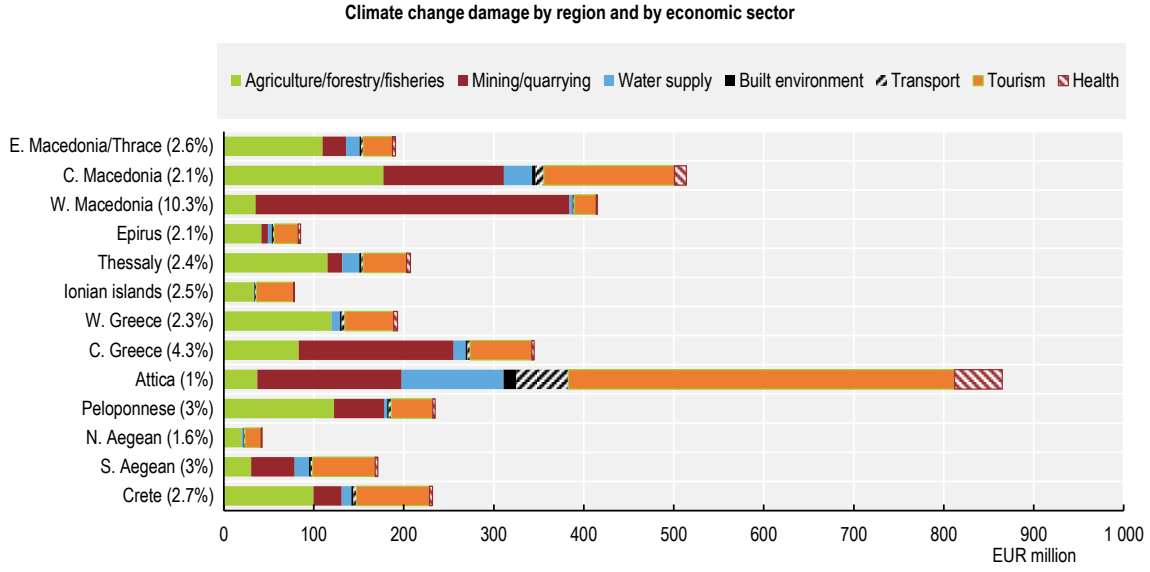
Greece has detailed climate projections and modelling on the environmental, social and economic impact of a changing climate. A geospatial database including climate data, maps and projections for the 13 regions is expected to be accessible online by 2020. The first comprehensive climate impact study was published in 2011 by an interdisciplinary committee set up by the Bank of Greece; an update is under way. The study found that precipitation levels would likely decline by between 5% and 19% countrywide by 2100, while temperatures would increase by between 3ºC and 4.5ºC. Heavy rainfall is projected to become more frequent in eastern and central Greece and in northwestern Macedonia, while drought would increase for the eastern mainland and northern Crete (Bank of Greece, 2011).

The Bank of Greece estimated that climate change could cause GDP to fall by up to 2% annually by 2050, and by up to 6% by 2100, in an inaction scenario.[9] The impact of climate change was found to be adverse, and often extremely adverse, for all economic sectors. Agriculture is among the sectors expected to be most severely affected by climate change, particularly in Central Macedonia, Peloponnese, Western Macedonia, Thessaly, Eastern Macedonia, Thrace and Crete (Figure 4.6). The consequences of climate change on tourism, mining, the built environment, transport, health and other sectors are also expected to be significant.

Figure 4.6. Agriculture will be the sector most severely affected by climate change



Notes: Based on the first attempt to estimate climate damage carried out by the Climate Change Impacts Study Committee (CCISC) of the Bank of Greece. Data in brackets refer to the percentage share of damage on sectoral value added.
Source: MoEE (2016), *National Climate Change Adaptation Strategy*.

StatLink https://doi.org/10.1787/888934155915

Particular significance is attributed to water reserves, given their implication for agriculture and for water and energy supply. Freshwater shortages and sea level rise are the highest-priority risks of climate change for Greece. Sea-level rise is projected at 20 to 200 cm by 2100, which makes about 1 000 km of the 18 400 km coastline highly vulnerable to climate change (Bank of Greece, 2011).

Freshwater shortages, linked to lower precipitation, decreased aquifer recharge and increased seawater infiltration, have implications for drinking water supply, ecosystems and energy supply. Higher water temperatures and reduced summer river flows are expected to reduce the usable capacity of thermal power plants dependent on river water for cooling, and hydropower production may be reduced by up to 10% (Hoegh-Guldberg et al., 2018). Moreover, higher temperatures and lower precipitation will increase the risk of forest fires, especially in eastern Greece (Bank of Greece, 2011).

4.6. Key policies and measures for adaptation

4.6.1. The institutional and policy framework

Greece strengthened its institutional and policy framework for adaptation over the review period. The National Adaptation Strategy (NAS) was adopted in 2016 and formally endorsed by the Parliament through Law 4414/2016. It sets out general objectives, guiding principles and implementation tools for adaptation policies and actions, with a horizon of ten years (i.e. it should be revised in 2026). The key objectives are to i) establish and enhance decision-making procedures; ii) link adaptation with sustainable growth through implementation of regional/local action plans; iii) promote adaptation in all economic sectors, especially the most vulnerable; iv) create a monitoring, evaluation and updating mechanism; and v) build capacity and raise awareness. It is intended to be a first step in a continuous and flexible approach to adapting to a changing climate (MoEE, 2016b).

The NAS identified 15 priority areas for intervention, drawn from the 2011 Bank of Greece report: agriculture and stock breeding, forestry, biodiversity and ecosystems, fisheries, aquaculture, water resources, coastal zones, tourism, energy, infrastructure and transport, health, the built environment, mining and quarrying, cultural heritage and the insurance sector. For each area it sets goals, general directions and potential action. As a strategy-oriented document, it does not provide in-depth analysis of required sectoral policies. Nor does it assess the feasibility of, or rank, individual adaptation measures and actions.

Law 4414/2016 provided for the establishment of the National Climate Change Adaptation Committee (NCCAC) to advise the MoEE and drive NAS implementation. The law made the NCCAC responsible for i) specifying and operationalising adaptation policies; ii) specifying horizontal policies and actions in the NAS, especially those concerning awareness and capacity building; iii) developing recommendations for review or revision of the NAS and regional action plans; and iv) developing recommendations for matters related to climate adaptation as put forward by the MoEE. The NCCAC is chaired by the minister of environment and energy and comprises representatives from relevant government authorities, the Union of Greek Regions, the Central Union of Greek Municipalities and the Hellenic Meteorological Service, as well as from industry, civil society and academia. Additional participants can be invited as needed. The NCCAC has been convened only once thus far.

Greece does not plan to develop a national action plan to implement the NAS. Instead, the 2016 law expects the 13 regions to develop Regional Adaptation Action Plans (RAAPs), in a 7-year planning cycle, to operationalise and implement the NAS. To ensure homogeneity and quality standards among the RAAPs, the NAS set common technical specifications for their content, which were further developed in Ministerial Decision 11258/2017. Each plan must contain a detailed assessment of potential climate change impacts, identify relevant risks, vulnerabilities and hotspots, prioritise adaptation actions on the basis of cost-effectiveness and benefits, and identify synergies with other policies, such as land use and water management plans. They are also required to outline budget needs and potential finance sources as well as a mechanism to monitor progress. The MoEE reviews the plans before they can be endorsed so as to ensure their compliance with the NAS. Development of the RAAPs is still under way. The implementation of adaptation action is expected to start as the RAAPs are finalised.

At that point the MoEE will analyse the vulnerabilities and priorities identified in the RAAPs and assess whether additional national action is needed. This bottom-up approach reflects and accounts for regional circumstances, but may delay national action. This is especially true for the sectors that have been identified as being the most vulnerable to climate change (e.g. agriculture, tourism), cross-cutting risks (e.g. water, infrastructure, energy) and sectors in which climate impacts are likely to go beyond regional boarders (e.g. coastal zones, health). The NCCAC and the special scientific committee on climate change could play an active role in identifying, prioritising and facilitating the development of vulnerability assessment and adaptation strategies for key sectors, where necessary.

Measuring progress and accountability

The RAAPs have to include an indicator-based monitoring and evaluation system that would allow monitoring of both the implementation and effectiveness of regional adaptation action. The NCCAC is formally tasked with monitoring and evaluation of climate change adaptation progress at the national level. In both cases, however, development of monitoring and evaluation frameworks has yet to start. As noted above, the NCCAC has convened only once. Regional governments may need support in developing their frameworks, given the complex nature of measuring effective adaptation actions: unlike with mitigation, no single metric can assess progress, and specific measures' effectiveness may only become clear over long time horizons. The OECD recommends a pragmatic combination of four tools: climate change risk and vulnerability assessments; indicators; evaluations and national audits; and climate change expenditure reviews (OECD, 2015).

One option would be to establish a technical committee under the NCCAC that, in addition to tracking national progress, could support regions in their development of monitoring and evaluation systems. It could also track the mainstreaming of adaptation into sector policies. The publication of regular progress reports could help build transparency and enhance accountability. Greece plans to develop a national monitoring and evaluation framework in 2020, learning from other OECD countries, such as Austria, Finland, Germany, Spain and the United Kingdom.

Building capacity and disseminating knowledge

The bottom-up approach of the NAS puts a relatively heavy burden on the regions to assess vulnerability, develop policy options, assess their relative costs and benefits, identify funding needs and sources, and monitor implementation and policy effectiveness. Most regions will require capacity building and support by the MoEE. To strengthen administrative and financial capacity, in 2017 the MoEE successfully applied for an EU LIFE action grant for a proposal named AdaptInGR: Boosting the Implementation of Adaptation Policy across Greece. AdaptInGR is planned as an eight-year project aiming to foster policy co-ordination, build capacity, facilitate knowledge dissemination and contribute to development of a monitoring and evaluation framework (Box 4.4). All are key areas for strengthening Greece's resilience to climate risks. At the end of the project, plans call for the MoEE and National Centre for Environment and Sustainable Development to take over training, monitoring and information-sharing responsibilities (EC, 2018).

There is also a need to disseminate good practice. Building on the experience of other OECD countries, such as France and Spain, Greece plans to establish a national adaptation platform or hub to inform target groups by 2020 (OECD, 2019). Such platforms can help pool adaptation-relevant data, build capacity through the sharing of experience and best practice, and foster co-operation among regions. The need to create a knowledge hub is recognised by the Greek authorities but implementation has been delayed due to resource constraints (EC, 2018).

Box 4.4. The LIFE-IP AdaptInGR project: Strengthening NAS implementation

The LIFE programme is the EU funding instrument for the environment and climate action, created in 1992. It has a budget of EUR 3.4 billion for 2014-20, one-fourth of which is dedicated to the climate change subprogramme.

The LIFE-IP AdaptInGR project benefits from funding from this subprogramme. The project has a budget of EUR 14.2 million for 2019-26, of which 59% is co-funded by the European Commission and 17% by the Green Fund. The project's overall goal is to support implementation of the NAS. It aims to build capacity for co-ordinating, prioritising, monitoring and mainstreaming adaptation policy actions, including by developing pilot projects in priority sectors for selected regions and municipalities. It also aims to support co-operation across Greek regions and with countries from the Balkans and the wider Mediterranean area, to develop and operate a National Adaptation Knowledge Hub, to develop and test methodologies to monitor NAS and RAAP implementation and to assess the current level of mainstreaming and integration of climate adaptation priorities into sector policies.

Source: EC (2019c); EC (2018).

Addressing transboundary impacts

The NAS recognises the need to address transboundary climate impacts, especially in light of the water resources and forests Greece shares with neighbouring countries. It calls for identifying transboundary adaptation issues, creating processes for joint policy development and shared data collection stations, and training and capacity building. The development of these measures is still under way (EC, 2018). The RAAPs are also expected to identify needs for international co-operation. Some important cross-boundary collaboration has already started, for example through bilateral co-operation programmes with Bulgaria, North Macedonia and Serbia and the Greece-Cyprus-Israel and Greece-Cyprus-Egypt trilateral co-operation agreements. Greece also promotes international co-operation on climate change impacts on cultural heritage (Box 4.5).

Box 4.5. Greece initiative to address the impact of climate change on cultural and natural heritage

Cultural and natural heritage is increasingly vulnerable to the adverse social and environmental effects of climate change. Greece, as a repository of a wealth of cultural heritage from antiquity to modern times, organised an international conference in Athens in 2019, gathering world-renowned scientists from over 40 countries, to raise awareness on this issue. The conclusions of the conference led to Greece's proposal to develop an international framework to strengthen cultural and natural heritage resilience to climate risks. It was launched in partnership with UNESCO and the World Meteorological Organization at the 2019 UN Climate Action Summit in New York. More than 70 UN member states and the Council of Europe have committed to the proposal. Greece plans to host a high-level international meeting in 2020 to adopt a policy declaration on the protection of cultural and natural heritage from the impact of climate change.

Source: https://ccich.gr/

4.6.2. Mainstreaming adaptation into sector policies

Climate change adaptation is considered in some sector strategies, such as the 2014 National Biodiversity Strategy and Action Plan and the 2018 National Strategy for Forests (Chapter 5), the Maritime Spatial Planning Law (Chapter 2) and the National Research and Innovation Strategy for Smart Specialisation (Chapter 3). The National Strategy for Forests, for example, calls for measures to adapt forest ecosystems to climate change and promotes forest ecosystem vulnerability assessments. Climate change is also integrated into national disaster risk management plans. However, these strategies generally do not specify how the various objectives interact. The NECP, for example, explicitly mentions the need for adaptation and refers to the NAS, but does not outline how climate change may affect energy supply (e.g. through reduced hydropower potential, cooling water shortages and the impact on biomass resources) or how proposed measures will make the energy system more resilient. Information is also lacking with respect to co-benefits, such as for thermal management of buildings, as the European Commission has noted (EC, 2019a). A planned analysis of synergies between mitigation and adaptation is expected to feed into the 2023 NECP update.

Other strategic planning documents for sectors likely to be affected by climate change, such as tourism, agriculture and water, include adaptation measures. However, implementation remains to be assessed. Climate change has yet to be effectively mainstreamed into water management plans or drought and water scarcity plans of the 14 river basin districts (EC, 2018). Moreover, no co-ordinated actions are undertaken in the field of coastal protection. The European Commission noted that nature-based solutions could be more systematically explored in the water sector to protect against flood risk cost-effectively.

The government expects the RAAPs to include adaptation action for sectors, which in turn would facilitate better mainstreaming and identification of the potential need for specific sector adaptation action plans. It will also be important to integrate the RAAPs into other relevant subnational plans, such as spatial and river basin plans. Integration of climate change impacts into environmental impact assessment (EIA) and strategic environmental assessment (SEA) can facilitate mainstreaming of climate change into sector policy. Adaptation is not explicitly mentioned in the national SEA legislation, although the MoEE gives its opinion on draft plans and their SEA reports through the SEA information and consultation process. Greece has transposed into national law the EU EIA Directive, which requires climate resilience to be considered in environmental assessment. Developing guidelines for project assessments could facilitate application of the law.

Recommendations on climate change mitigation and adaptation

Policy and institutional framework

- Implement the NECP to put the economy on a long-term decarbonisation pathway. Endorse a long-term, economy-wide mitigation strategy, with contributions by sectors, that is consistent with the EU goal of climate neutrality by 2050.
- Develop and implement a Just Transition Plan to support lignite-dependent areas.
- Ensure the national adaptation committee convenes regularly and has the resources to exercise its legal mandate. Consider asking the committee to identify priority policy areas where regional action plans should be complemented by national-level plans (e.g. on tourism, agriculture).

Monitoring and evaluation

- Set up a comprehensive monitoring and evaluation mechanism with clear roles and responsibilities to track the status of implementation of mitigation and adaptation policies and measures. Conduct, where possible, cost-benefit and cost-effectiveness analysis to inform measures' prioritisation.

Mitigation

- Continue to reduce the carbon intensity of power generation by phasing out lignite on schedule by 2028, pursuing the planned interconnection of non-interconnected islands, investing in renewables and developing storage system operation framework, including hybrid plants on autonomous islands.
- Implement ambitious energy efficiency policies, drawing on evaluation of outcomes from past and current measures. Strengthen the building renovation strategy to decarbonise the building stock by 2050, as required by EU law.
- Develop quantified targets and action plans to reduce energy intensity in transport and decarbonise the sector, focusing on intermodality and vehicle fleet renewal. Ensure coherence of climate targets in the NEPC and National Transport Plan.

Adaptation

- Ensure that adaptation considerations are integrated in the sectors most affected by climate change, including water, agriculture and tourism.
- Develop guidelines on mainstreaming adaptation into major projects or programmes. Make climate resilience part of strategic environmental assessment.

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Notes

[1] All numbers presented in this section exclude emissions from land use, land-use change and forestry.

[2] Greece's mitigation target for the Kyoto Protocol second commitment period (2013-20) as well as its targets for 2020 and 2030 set by EU regulations only concern emissions outside the EU ETS. For emissions covered by the ETS, an EU-wide cap is in place to reduce emissions by 21% from the 2005 level by 2020 and by 43% by 2030.

[3] In 2009, the newly established MoEE retained the environment and physical planning portfolio of the former Ministry for the Environment, Physical Planning and Public Works as well as the General Directorate of Energy and Natural Resources previously under the Ministry of Development and the General Directorate of Forest Development and Protection and Natural Resources previously under the Ministry of Rural Development and Food.

[4] C40 is a network of megacities committed to addressing climate change. C100 is a network dedicated to helping cities become more resilient to 21st century physical, social and economic challenges.

[5] An EU-wide cap is in place to reduce emissions in EU ETS sectors by 21% from the 2005 level by 2020 and by 43% by 2030.

[6] Greece will introduce a forward, intraday, and balancing market over a transition period to 2020, to complement the day-ahead market.

[7] Under EU legislation, EU countries must ensure that GHG emissions from LULUCF are offset by at least an equivalent removal of CO_2 from the atmosphere over 2021-30. This is known as the "no debit" rule.

[8] "Green direct payments" support farmers who adopt or maintain farming practices that help meet environmental and climate goals. EU countries have to allocate 30% of their income support to greening.

[9] The 2011 study considered three main scenarios: an inaction scenario, assuming no action is taken to reduce anthropogenic GHG emissions; a mitigation scenario, assuming the average global temperature would not increase by more than 2ºC by 2100; and an adaptation scenario. The study estimated that GDP could fall by up to 2% annually by 2050 and by up to 6% by 2100 in an inaction scenario. A mitigation scenario would cut this by 40% and an adaptation scenario by 20% (Bank of Greece, 2011). Under all scenarios, climate change is expected to adversely (and often very adversely) affect economic sectors, ecosystems, food security, human health and cultural heritage. Agriculture, tourism and mining are the most severely affected economic sectors.