OECD Environmental Performance Reviews

Greece 2020



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OECD Environmental Performance Reviews: Greece 2020



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Foreword

The principal aim of the OECD Environmental Performance Review programme is to help member and selected partner countries improve their individual and collective performance in environmental management by:

- helping individual governments assess progress in achieving their environmental goals
- promoting continuous policy dialogue and peer learning
- stimulating greater accountability from governments towards each other and public opinion.

This report reviews the environmental performance of Greece since the previous review in 2009. Progress in achieving domestic objectives and international commitments provides the basis for assessing the country's environmental performance. Such objectives and commitments may be broad aims, qualitative goals or quantitative targets. A distinction is made between intentions, actions and results. Assessment of environmental performance is also placed within the context of Greece's historical environmental record, present state of the environment, physical endowment in natural resources, economic conditions and demographic trends.

The OECD is indebted to the government of Greece for its co-operation in providing information, for the organisation of the review mission to Athens (25-28 June 2019), and for facilitating contacts both inside and outside government institutions.

Thanks are also due to the representatives of the two examining countries, Tamar Raviv (Israel) and Mario Reis (Portugal).

The authors of this report were Britta Labuhn, Eugene Mazur, Alexa Piccolo and Frédérique Zegel from the OECD Secretariat. Nathalie Girouard and Frédérique Zegel provided oversight and guidance. Carla Bertuzzi provided statistical support, Shellie Phillips provided administrative support and Rebecca Brite copy-edited the report. Natasha Cline-Thomas provided communications support. Preparation of this report also benefited from inputs and comments from several members of the OECD Secretariat, including, Dimitris Diakosavvas, Catherine Gamper, Guillaume Gruère, Eeva Leinala and Dimitra Xynou as well as Peter Journeay-Kaler of the International Energy Agency.

The OECD Working Party on Environmental Performance discussed the draft Environmental Performance Review of Greece at its meeting on 26 February 2020 in Paris and approved the assessment and recommendations.

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Reader's guide

Signs

The following signs are used in figures and tables:

..	:	not available
_	:	nil or negligible
.	:	decimal point

Country aggregates

OECD Europe: This zone includes all European member countries of the OECD, i.e. Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

OECD: This zone includes all member countries of the OECD, i.e. the countries of OECD Europe plus Australia, Canada, Chile, Israel, Japan, Korea, Mexico, New Zealand and the United States.

Country aggregates may include Secretariat estimates.

Colombia was not an OECD Member at the time of preparation of this publication. Accordingly, Colombia does not appear in the list of OECD Members and is not included in the zone aggregates.

Currency

Monetary unit: Euro (EUR)

In 2019, USD 1 = EUR 0.893

In 2018, USD 1 = EUR 0.847

Cut-off date

This report is based on information and data available up to January 2020.

Abbreviations and acronyms

CBD	Convention on Biological Diversity
CO_2 eq	Carbon dioxide equivalent
DMC	Domestic material consumption
EC	European Commission
EEA	European Environment Agency
EED	Energy Efficiency Directive
EI	Hellenic Environmental Inspectorate
EIA	Environmental impact assessment
EPR	Environmental Performance Review
ETS	Emissions Trading System
EU	European Union
FIP	Feed-in premium
FIT	Feed-in tariff
GDP	Gross domestic product
GHG	Greenhouse gas
IEA	International Energy Agency
IUCN	International Union for Conservation of Nature
LULUCF	Land use, land-use change and forestry
MoEE	Ministry of Environment and Energy
MRDF	Ministry of Rural Development and Food
Mtoe	Million tonnes of oil equivalent
NAS	National Adaptation Strategy
NCCAC	National Climate Change Adaptation Committee
NBSAP	National Biodiversity Strategy and Action Plan
NECP	National Energy and Climate Plan
NGO	Non-government organisation
NREAP	National Renewable Energy Action Plan

NOx	Nitrogen oxides
NSSFG	National Strategy for Sustainable and Fair Growth
PM10	Particulate matter smaller than 10 microns in diameter
PM2.5	Particulate matter smaller than 2.5 microns in diameter
PPC	Public Power Corporation
PPP	Purchasing power parity
R&D	Research and development
RAAP	Regional Adaptation Action Plan
RBMP	River Basin Management Plan
RDP	Rural Development Programme
RIA	Regulatory impact analysis
SDG	Sustainable Development Goal
SEA	Strategic environmental assessment
SMEs	Small and medium-sized enterprises
SOx	Sulphur oxides
SYGAPEZ	Co-ordination Office for Mitigation of Environmental Damage
TPES	Total primary energy supply
USD	United States dollar

Basic statistics of Greece, 2019

2018 or latest available year (OECD values in parenthesis)[1]

PEOPLE AND SOCIETY					
Population (million)	11		Population density per km^2	80	(36)
Share of population by type of region			Population annual growth rate, latest 5 years	-0.4	(0.6)
Predominantly urban (%)	45	(47)	Income inequality (Gini coefficient)	0.33	(0.32)
Intermediate (%)	23	(27)	Poverty rate (% of pop. with less than 50% med. income)	14	(12)
Rural (%)	32	(25)	Life expectancy	81	(81)
ECONOMY AND EXTERNAL ACCOUNTS					
Total GDP (National currency, billion)	185		Imports of goods and services (% of GDP)	36	(29)
Total GDP (USD billion, current PPPs)	317		Main exports (% of total merchandise exports)		
GDP compound annual real growth rate, latest 5 years	0.7	(2.3)	Petroleum, petroleum products and related materials	33	
GDP per capita (1 000 USD current PPPs)	30	(46)	Non-ferrous metals	7	
Value added shares (%)			Vegetables and fruits	6	
Agriculture	4	(2)	Main imports (% of total merchandise imports)		
Industry including construction	17	(25)	Machinery and transport equipment	26	
Services	79	(73)	Miscellaneous manufactured articles	6	
Exports of goods and services (% of GDP)	36	(29)	Manufactured goods	4	
GENERAL GOVERNMENT Per cent of GDP					
Expenditure	47	(40)	Education expenditure	4.2	(5.1)
Revenue	48	(38)	Health expenditure	5.2	(7.7)
Gross financial debt	189	(110)	Environmental protection expenditure	1.3	(0.5)
Fiscal balance	0.8	-(2.3)	Environmental taxes (% of GDP)	3.7	(1.6)
			(% of total tax revenue)	9.5	(5.3)
LABOUR MARKET, SKILLS AND INNOVATION					
Unemployment rate (% of civilian labour force)	19.3	(5.3)	Patent in environment-related technologies (% of all technologies, average of latest 3 years)[2]	11	(10)
Tertiary educational attainment of 25- to 64-year-olds (%)	32	(36.9)	Environmental management	4	(4)
Gross expenditure on R&D (% of GDP)	1.13	2.37	Water-related adaptation technologies	1	(0.5)
Unemployment rate (% of civilian labour force)	19.3	(5.3)	Climate mitigation technologies	9	(8)
ENVIRONMENT					
Energy intensity TPES per capita (toe/cap.)	2.2	(4.1)	Road vehicle stock (vehicles/100 inhabitants)	88	
TPES per GDP (toe/1 000 USD 2010 PPPs)	0.09	(0.10)	Water stress (abstraction as % of available resources)	16	(9)
Renewables (% of TPES)	13	(10)	Water abstraction per capita (m^3/cap./year)	1 059	(715)
Carbon intensity (energy-related CO_2)			Municipal waste per capita (kg/capita)	512	(520)
Emissions per capita (t/cap.)	5.9	(8.93)	Material productivity (USD, 2010 PPPs/DMC, kg)	2.2	(2.6)
Emissions per GDP (t/1 000 USD 2010 PPPs)	0.23	(0.23)	Land area (1 000 km^2)	129	
GHG intensity[3]			% of arable land and permanent crops	25	(12)
Emissions per capita (t CO_2 eq/cap.)	9.0	(11.9)	% of permanent meadows/pastures	22	(22)
Emissions per GDP (t CO_2 eq/1 000 USD 2010 PPPs)	0.37	(0.31)	% of forest area	32	(31)
Mean population exposure to air pollution ($PM_{2.5}$), µg/m^3	16.5	(12.50)	% of other land (built-up/other land)	21	(34)

1. Values earlier than 2013 are not taken into consideration. OECD value: where the OECD aggregate is not provided in the source database, a simple average of latest available data is calculated where data exist for a significant number of countries.
2. Patent applications for higher-value inventions that have sought protection in at least two jurisdictions.
3. Excluding emissions/removals from land use, land-use change and forestry. Emissions expressed in CO_2 equivalent.
Source: Calculations based on data from databases of the OECD, Eurostat, IEA/OECD and World Bank.

Executive summary

Greece has made progress in decoupling emissions from GDP but faces challenges in several environmental areas

Greece underwent extensive reforms to cope with a deep recession. The economy started to recover in 2017. Between 2009 and 2017, some environmental pressures, such as emissions of GHGs, sulphur oxides and nitrogen oxides, declined faster than GDP. Since 2013, however, energy consumption, municipal waste generation and pesticide use have grown more quickly than economic activity. Air pollution has declined but Greece lacks a programme to reduce significant negative health effects. In general, improved monitoring and information will help strengthen environmental management.

In a welcome move, Greece adopted a National Circular Economy Strategy and introduced a tax on single-use plastic bags. However, most municipal waste ends up in landfills, not all of which comply with EU requirements, and hazardous waste management remains a challenge. Efforts are needed to set up adequate treatment infrastructure and apply economic instruments that encourage moving up the waste hierarchy.

Water scarcity is expected to intensify with climate change. Freshwater abstraction is high due to irrigation and leakage. Ensuring that prices cover the cost of supply and reflect scarcity, along with improving agri-environmental measures' effectiveness, will support sustainable water management. Efforts to reduce the environmental impact of agriculture should include a system for collection and safe disposal of pesticide containers.

Compliance monitoring and enforcement must be stepped up

Greece has undertaken a major effort to streamline environmental and spatial planning legislation to lessen the administrative burden on businesses while maintaining alignment with EU directives. However, non-compliance is high: most national-level inspections identify violations, and illegal construction remains a major environmental concern.

Staff cuts in the central Environmental Inspectorate have reduced compliance monitoring. The vast majority of inspections are unplanned, coming in reaction to incidents and complaints. Authorities at all administrative levels are missing activity targets of the national environmental inspection plan. Substantial inspection capacity increases are needed, in addition to the recent emphasis on compliance promotion. Enforcement tools are adequate but need to be applied better: collection of administrative fines is a significant problem.

The country has renewed its commitment to sustainable development but needs to enhance environmental-sectoral policy coherence and leverage green investment

In 2018, Greece renewed its commitment to sustainable development in a voluntary national review on implementation of the 2030 Agenda. However, ensuring coherence between environmental and sector policies such as energy, transport, agriculture and tourism is challenging.

The share of revenue from environmentally related taxes in GDP doubled over the decade, driven by increased energy taxation. Effective tax rates on CO_2 emissions from energy use are relatively high but carbon price signals are inconsistent. Support to fossil fuel consumption accounts for more than one-quarter of energy tax revenue. Greece should identify environmentally harmful subsidies and prioritise which to phase out.

The country has some of the OECD's highest petrol prices and taxes. However, the taxation gap with diesel is also among the largest, despite diesel being more polluting. Renewing the vehicle fleet, one of the oldest in Europe, requires harmonising taxation of new and old vehicles. The 2019 Law on Tax Reform introduced environmental criteria in the tax treatment of personal use of company cars and commuting expenses.

Effective use of EU funds is key to addressing significant infrastructure needs for waste and wastewater treatment. Environmental protection has been particularly affected by the overall decline in investment. Projects have been delayed by poor planning and capacity limitations. While the motorway network doubled over the decade, rebalancing investment from road to sustainable modes would help reduce reliance on cars.

Greece is implementing an ambitious energy transition to 2030

Greece is on track to meet the 2020 and 2030 targets for GHG emissions not covered by the EU Emissions Trading System. The economic crisis, which reduced energy demand, explains much of the decline in GHG emissions in the past decade, although a shift towards cleaner energy played a role. Despite significant deployment of renewables, the economy is still strongly reliant on fossil fuels.

In a welcome move, the government announced a lignite phase-out by 2028 and committed to achieving climate neutrality by 2050. It endorsed a National Energy and Climate Plan (NECP) with ambitious targets for 2030. The plan envisages emissions declining primarily due to decreases from power generation, with emissions in non-energy sectors falling slightly. Promotion of natural gas and renewables, interconnection of islands with the mainland grid and decommissioning of lignite power units are the main measures; they need to be supplemented by a transition plan for lignite-dependent regions. Greece has developed a Long-term Strategy to 2050. Additional policies will be necessary as continuation of NECP measures beyond 2030 will not be sufficient to reach climate neutrality by mid-century.

The country should pursue efforts to adapt to climate change impacts on water, agriculture and tourism

As a Mediterranean country with thousands of islands, Greece is highly vulnerable to the impact of climate change. Sea level rise and freshwater shortage are the priority risks associated with the projected rise in temperatures and decrease in precipitation levels. The country has strengthened its policy and institutional framework for adaptation. The design and implementation of concrete adaptation action, however, are a work in progress. As regions have significant responsibility for developing action plans taking their circumstances and needs into account, capacity building and cross-government co-ordination are needed to align policies and share knowledge. Progress has been made in considering adaptation in some sector strategies but there is room for improvement in water, agriculture and tourism.

Biodiversity conservation requires improved monitoring and further integration with agriculture, fisheries, transport and tourism

Greece hosts abundant European and Mediterranean flora and fauna, including endemic species, and a wide variety of ecosystems and habitats, many of which are of international interest. Habitat conservation status has improved but more than half of species are in an unfavourable state. The main causes of biodiversity loss are urbanisation, habitat fragmentation, pollution, invasive alien species, climate change and fires.

The legal framework is in line with international commitments but Greece lacks a comprehensive biodiversity monitoring system. According to national data, the country achieved the 2020 Aichi target on protected areas but few have management plans or the resources to implement them. Preparation of the biodiversity action plan beyond 2019 is an opportunity to take stock of progress.

As in most OECD countries, there is a need to better mainstream biodiversity into economic sectors. Key pressures come from agriculture, fisheries, transport and tourism, especially coastal. As tourism expands, it is increasingly important to link the sector and national biodiversity priorities. Assistance to farmers to implement agri-environmental measures can help mainstream biodiversity into agriculture. Further integration of biodiversity concerns into spatial planning would go a long way towards protecting species and habitat

Assessment and recommendations

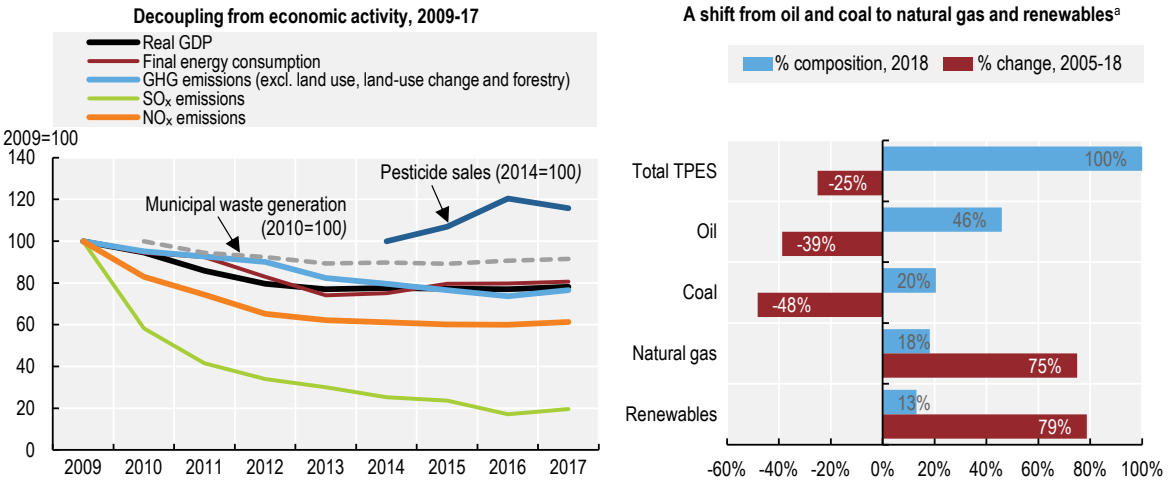
This document presents the Assessment and Recommendations of the OECD Environmental Performance Review of Greece. It was discussed, amended and approved by the OECD Working Party for Environmental Performance on 26 February 2020

1.1. Environmental performance: trends and recent developments

After a long, deep recession, the Greek economy started to recover in 2017. The country has undergone extensive fiscal and structural reforms, but faces difficult challenges in improving well-being, income and employment and reducing poverty. Between 2009 and 2017, some environmental pressures, notably emissions of greenhouse gases (GHGs), sulphur oxides (SO_X) and nitrogen oxides (NO_X), declined faster than GDP (Figure 1). Since 2013, however, energy consumption, municipal waste generation and pesticide use have grown more quickly than economic activity.

Although the energy mix has been shifting from oil and coal (lignite) to natural gas and renewable resources, Greece ranks among the ten most carbon-intensive economies in the OECD due to its strong reliance on fossil fuels. In addition, agriculture, transport, tourism and fisheries put pressure on the country's biological wealth.

Figure 1. Some environmental pressures declined and the energy mix changed



a) Total primary energy supply (TPES). The breakdown does not show electricity trade.
Source: Eionet (2019), *NECD Inventory 2019*; IEA (2019), *IEA World Energy Statistics and Balances* (database); OECD (2019), *OECD Agriculture Statistics* (database); OECD (2019), *OECD Environment Statistics* (database).

StatLink https://doi.org/10.1787/888934155212

Greece has made progress towards its climate and energy targets

Greece surpassed its Kyoto target for the first commitment period and is on track to meet the 2020 and 2030 targets for emissions not covered by the EU Emissions Trading System (EU ETS) (Section 4). In a welcome move, the government that was elected in July 2019 announced a lignite phase-out by 2028 and committed to the objective of climate neutrality by 2050.

The country developed a National Energy and Climate Plan (NECP) and a Long-term Strategy to 2050 in 2019 (MoEE, 2019) (MoEE, 2020). By 2030, the plan aims to i) reduce total GHG emissions, excluding those from land use, land use change and forestry (LULUCF), by 56% from 2005 levels (42% from 1990 levels); ii) reduce GHG emissions not covered by the EU ETS by 36% from 2005 levels, more than twice the reduction required for Greece by the relevant EU directive (16%);[1] 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. The NECP expects promotion of renewables and improvement of the power system (decommissioning of all lignite power plants, expansion of gas-fired generation, interconnection of certain islands with the mainland grid) to contribute the most to GHG emission reduction.

Energy supply and demand dropped significantly in the aftermath of the economic crisis. Energy intensity (energy supply per unit of GDP) is below the OECD average but has decreased more slowly than in most other OECD countries. Transport accounts for the highest share of final energy consumption, followed by the residential sector and industry. Despite an increase in energy consumption since 2013, Greece is on track to reach its 2020 target on energy efficiency.

Significant progress has been made in deploying renewables (mainly wind and solar photovoltaics). In 2018, renewables accounted for 13% of total primary energy supply and 31% of electricity generation, above the respective OECD averages of 10% and 26%. The country achieved the overall binding target of 18% share of renewables in gross final energy consumption, set for Greece by the EU Renewable Energy Directive for 2020, but is unlikely to meet the sub-targets on electricity and transport.

Air emissions have dropped but urban air pollution is high

Since 2009, emissions of major air pollutants have decreased faster than economic activity. Reduced energy consumption, flue gas desulphurisation, changes in the electricity mix (increased use of gas and renewables, decommissioning of old coal power plants), reduction of fuels' sulphur content and scrapping of old vehicles have been the main drivers of this decline. However, levels of emission intensity per unit of GDP remain high, especially for NO_X emissions, mainly due to oil-based transport (OECD, 2019a). According to national projections, Greece is on track to meet its 2020 and 2030 emission reduction commitments under the National Emission Ceilings Directive. However, it has fallen behind in developing a national air pollution control programme.[2]

Although concentrations of the main air pollutants have decreased in the past decade, progress has stalled since fuel consumption started to grow again in 2013. In 2017, exceedances of EU air quality standards were recorded for NO_2, PM_{10}, benzene, benzo[a]pyrene and ozone (EEA, 2019a). Premature mortality statistically attributed to exposure to $PM_{2.5}$ and ozone pollution is among the highest in the OECD (OECD, 2019b). Natural sources, such as Saharan dust, are a significant factor in particulate pollution, especially in the south (Klein et al., 2019). Improving the air quality monitoring system would help in increasing the accuracy of exposure estimates and designing appropriate measures to reduce the health impact of air pollution.

The transition to a circular economy should be accelerated

In the aftermath of the financial crisis, domestic material consumption decreased faster than GDP as construction and coal extraction declined and renewables use increased. However, the material intensity of the economy remains higher than the OECD average, mainly owing to significant use of fossil energy material (OECD, 2019c).

According to the State of the Environment report, waste management is the most challenging environmental area (NCESD, 2018). Since 2013, municipal waste generation has been increasing faster than private consumption. In 2017, 80% of municipal waste generated was sent to landfill, nearly twice the OECD average. Greece missed the EU target of halving the amount of landfilled biodegradable municipal waste from the 1995 level by 2013. It is at risk of missing the 2020 Waste Framework Directive target of preparation of half of municipal waste for reuse/recycling.

In 2018, Greece adopted a National Circular Economy Strategy and a two-year action plan, later extended to 2023.The 2017 Law on Recycling aligned existing legislation with circular economy principles. The country also established a multi-stakeholder forum to promote circular economy business models and innovations. It has made strides in closing illegal landfills and expanding extended producer responsibility systems. However, more than 50 dumping sites[3] still do not comply with EU requirements, and hazardous waste management remains a challenge. Major efforts are needed to set up adequate treatment infrastructure and better enforce waste regulations (BiPRO, 2017) Data quality issues persist despite the establishment of an electronic waste registry in 2017. There is room to improve performance and oversight of extended producer responsibility systems.

In a welcome move, Greece introduced a tax in 2018 that significantly reduced consumption of single-use plastic bags. A 2019 law provides for a long-awaited landfill tax as part of a pricing policy based on regional and local waste management authorities' performance in recovering and diverting waste from landfill. Waste collection charges are generally based on property size. There is thus room to develop "pay as you throw" systems as part of instruments to encourage people to reduce waste.

Freshwater abstraction is high and water scarcity issues are expected to intensify with climate change

As Greece is generously endowed with freshwater resources, water stress at the national level is moderate but spatial and seasonal distribution and use vary widely (OECD, 2019d). Climate change is expected to increase pressure on water availability, especially in Attica, Central Macedonia, Thessaly, East Macedonia-Thrace and the South Aegean islands (MoEE, 2016). The country has one of the OECD's highest rates of water abstraction per capita, due in part to irrigation, which benefits from partial cost recovery and reduced electricity prices, and in part to leakage in the distribution system (EC, 2018a) (National Bank of Greece, 2015). The 2017 law on water pricing is expected to ensure cost recovery and promote sustainable water management.

The second River Basin Management Plans show that slightly more than 60% of surface water bodies achieved good ecological status, while 89% of surface water bodies and 85% of groundwater bodies reached good chemical status. Greece has improved its water monitoring system but changes in methods make it hard to infer trends in water abstraction and quality. Compliance rates with Drinking Water Directive requirements are high. Most bathing waters are of excellent quality.

Greece has made progress in wastewater treatment in large agglomerations: 90% of the wastewater load is collected and treated in urban wastewater treatment plants. However, the remaining 10% of the load is dealt with by individual systems which should be replaced by collecting systems and treatment plants where population density is high enough (EC, 2017).

Efforts to reduce the environmental impact of agriculture are needed

Over the past decade, nutrient surpluses have declined, but the use of fertilisers and pesticides has increased in recent years. The 2013 National Action Plan on Sustainable Use of Pesticides helped in certifying professional users and reducing acute poisoning incidents, although the targets to inspect sprayers[4] and reduce non-compliance with maximum pesticide residue limits[5] have not been achieved (Bourodimos et al., 2018). More than half of professional users dispose of empty pesticide packages in common waste bins, a further 12% do so without rinsing them, 19% burn or bury containers and less than 10% participate in collection/recycling programmes (MRDF, 2016). It is imperative to establish a system for the collection and safe disposal of empty pesticide containers and to further educate farmers about pesticide risks.

Diffuse pollution and abstraction for irrigation are the main agricultural pressures on water. Groundwater is threatened by salinisation caused by intensive groundwater pumping in coastal areas, leading to seawater intrusion. Water conservation efforts mostly focus on improving irrigation efficiency. Investment in infrastructure contributed to a slight reduction in abstraction for irrigation per hectare of cultivated area between 2015 and 2018, though the volume abstracted increased with the expansion of irrigated areas (AUA, 2019). Under the Rural Development Programme, agri-environmental measures have been found to have positive effects on soil erosion and reduction of nitrogen surplus. Their net effect on water savings and quality and on biodiversity would require a more detailed assessment. In 2019, Greece adopted an action plan to protect water from agricultural pollution covering all 30 vulnerable areas for nitrate pollution.

Box 1. Recommendations on air and water management, waste and circular economy

Air quality

- Swiftly adopt and implement the national air pollution control programme to comply with standards for protection of human health; further promote replacement of inefficient oil and biomass heating systems.
- Further improve the air quality monitoring system and develop knowledge of the drivers of air pollution and its impact on health.

Waste and circular economy

- Close and remediate the remaining illegal landfills without further delay.
- Build treatment facilities for the main hazardous waste streams.
- Improve the quality of waste statistics and the oversight of extended producer responsibility systems.
- Extend separate collection of waste, including biowaste, by establishing minimum service standards. Expand the use of "pay as you throw" systems as part of instruments to encourage people to reduce waste. Ensure effective implementation of the new waste pricing policy.
- Strengthen the institutional and policy framework to speed up the transition towards a circular economy by all economic sectors.
- Swiftly establish a system for collection and safe disposal of empty pesticide containers and promote farmer education about pesticide risks. Develop an extended producer responsibility system for agricultural plastics.

Water management

- Continue to improve water monitoring to build consistent time series of data on water abstraction and quality.
- Complete the infrastructure for the collection and treatment of urban wastewater in line with the EU requirements.
- Implement the action plan to protect water against pollution caused by nitrates from agricultural sources in all vulnerable areas.
- Further assess the impact of agri-environmental measures on water and biodiversity to improve their design in Greece's Strategic Plan under the Common Agricultural Policy 2021-27.

1.2. Environmental governance and management

Since the last Environmental Performance Review (EPR), Greece has made major efforts to streamline its environmental and spatial planning legislation so as to lessen the administrative burden on businesses. Increased government transparency has helped strengthen environmental democracy. However, ensuring compliance with environmental laws and regulations in the country's decentralised governance system is a significant challenge, further complicated by shortages of human and financial resources due to extensive fiscal and structural reforms. Reduced regulatory pressure combined with weak compliance represents an environmental risk, and many good international practices of environmental policy implementation have only recently been introduced.

National institutions have grown stronger, but co-ordination with the subnational level needs improvement

The Ministry of Environment and Energy (MoEE) holds most environmental policy and regulatory powers at the central level. Decentralised administrations of the national government have significant environmental management responsibilities, particularly with respect to spatial planning. Multiple horizontal co-ordination mechanisms are dedicated to the pursuit of policy coherence, implementation of Sustainable Development Goals (SDGs), environmental information exchange and key issues such as climate change, water and waste management, spatial planning and circular economy.

The regional and municipal government levels are administratively and financially independent and manage local matters in accordance with the subsidiarity principle. Regions regulate activities with low environmental impact, and municipalities deliver water- and waste-related environmental services. Decentralised administrations supervise local governments only with regard to the legality of their actions, not the substance of their policies. However, vertical co-ordination between the national and local governments' environmental policies should be enhanced.

Permitting reform reduced the regulatory burden on businesses, but special provisions can weaken environmental governance

Greece has updated and streamlined core environmental legislation to meet European Union (EU) and wider international obligations and enhance its coherence. However, the country still has a significant number of EU directive infringements, particularly in the area of waste. It simplified planning and licensing procedures to reduce the administrative burden on the regulated community, facilitate investment and create a business-friendly environment.

The 2011 Law on Environmental Permitting and its implementing regulations joined the environmental impact assessment (EIA) and permitting processes and completed cross-media integration of environmental permits. Importantly, low-impact activities, which account for about 70% of operators, became subject to standard environmental obligations (attached to an operating licence), in line with good international practice. However, extension of environmental permits for certain projects (e.g. power plants on off-grid islands, hotels, quarries) through special regulations without appropriate EIA (WWF, 2018) weakens environmental governance.

Strategic environmental assessment (SEA) of plans and programmes is regularly used. However, Greece ranks among the bottom five OECD countries on the quality of regulatory impact assessment (RIA) of laws and regulations (OECD, 2018). Cost-benefit analysis is seldom used. Many policies and programmes have implementation monitoring provisions. *Ex post* evaluations are envisaged in a 2019 law on government operations but are not yet part of established management tools.

Spatial planning is complex and undermined by illegal construction

Greece has committed to finally complete its land cadastre by mid-2021 after several attempts over the past 25 years. The land-use planning system is a complex combination of territorial, sector-specific and special regimes, all of which undergo SEA. However, local spatial plans are often absent. Special plans for strategic investments and public estates may override regional and local plans to fast-track strategic investment projects, often with expedited environmental permitting, creating a potential environmental risk (OECD, 2017a).

Illegal construction, particularly in coastal and forest areas, remains a major environmental concern. Addressing illegal construction is a government priority. The 2009 EPR recommendation to strictly enforce spatial plans and building permit regulations has not been fully implemented (OECD, 2010). Recent legislation preserved certain conditions that allow retroactive legalisation of illegal housing development. The spatial planning framework for marine and coastal areas adopted in 2018 is a positive step, with a National Maritime Spatial Strategy expected in 2020.

Compliance assurance is a major challenge

The rate of environmental non-compliance is high. Yet drastic staff cuts at the MoEE's environmental inspectorate have led to a sharp decline in the number of inspections at the national level. Compliance monitoring is predominantly in reaction to incidents and complaints. Despite the adoption in 2017 of a first five-year national environmental inspection plan, inspections based on risk assessment represent a small percentage of the total inspections conducted. Administrative fines are high, on average, but about a third remain unpaid.

The 2018 Law on Supervision of Economic Activities de-emphasises enforcement sanctions in favour of softer treatment of businesses. In line with good international practice, the government uses regulatory incentives (longer permit terms, licensing fee and insurance premium reductions) to encourage operators to adopt and certify environmental management systems. However, other instruments to promote environment-friendly behaviour, such as voluntary agreements and green public procurement (GPP), should be used more.

Greek law establishes strict liability for environmental damage (fault-based for damage to biodiversity) and specifies criteria for its assessment and remediation. Dedicated institutions at the national and regional levels handle environmental liability cases. The use of financial guarantees against environmental damage is mandatory for high-risk activities but in practice has so far been limited to hazardous waste management activities. This puts a significant burden on the state for environmental remediation if the responsible party is insolvent.

Greece is assessing and remediating several dozen contaminated sites of illegal municipal and industrial hazardous waste landfills, mostly with EU support. However, action plans on closing remaining illegal waste dumps are implemented with delays. No coherent regulatory process or standards for soil remediation exist.

Transparency and accountability on environmental matters have increased

Greek law guarantees broad access to justice on environmental matters for individuals and non-government organisations, which can file suits in administrative or regular courts. Accountability is enhanced by the office of the ombudsman, which has a dedicated team of investigators. It addresses cases of poor administrative practices related to the environment and urban planning, including wrongful permitting, illegal construction, and violation of protected areas and the coastline.

Greece has enhanced the effectiveness of public consultation and environmental information dissemination by using online platforms. Public participation in EIA, SEA and river basin management

planning is mandatory, as is consultation on draft primary legislation. However, public consultation on draft regulations is sometimes too short to be meaningful, and supporting and explanatory materials may be lacking (IEEP, 2019).

The MoEE has launched a national geoportal which provides access to environmental geospatial data. Access to environmental information is legally guaranteed, but practical accessibility and adequate interpretation could be improved through a coherent framework for data collection, classification and maintenance by various authorities.

Box 2. Recommendations on environmental governance and management

Strengthening the institutional and regulatory framework

- Enhance collaboration on environmental matters between the national, regional and municipal governments through, among other measures, co-ordination of compliance assurance activities and information exchange.
- Expand the use of ex ante cost-benefit analysis and *ex post* evaluation of regulations, policies and programmes.
- Avoid special provisions in environmental permitting.
- Increase substantially the share of the territory covered by local spatial plans so as to limit the use of special land-use planning regimes for strategic investments and public estates; end retroactive legalisation of illegal construction; adopt and implement spatial plans for marine and coastal areas in the framework of integrated coastal zone management.

Improving enforcement and compliance

- Increase the share of planned inspections based on risk assessment at the national and subnational levels; strengthen the capacity of all environmental inspection authorities.
- Enforce payment of fines through administrative and judicial measures; better monitor and measure effectiveness of enforcement actions.
- Expand GPP and the use of voluntary agreements with industry to promote green business practices.
- Develop standards and procedures for soil remediation.

Enhancing environmental democracy

- Improve the quality and usability of publicly accessible environmental information by dedicating more resources to its collection and management; support more active public participation in environmental decision making.

1.3. Towards green growth

Greece has renewed its commitment to sustainable development but needs to enhance policy coherence

After a severe recession, the economy started to recover in 2017. Despite progress on some environmental commitments made in economic adjustment programmes, the economy remains highly reliant on fossil fuels, road transport is predominant and compliance with EU requirements on waste and water management is a challenge.

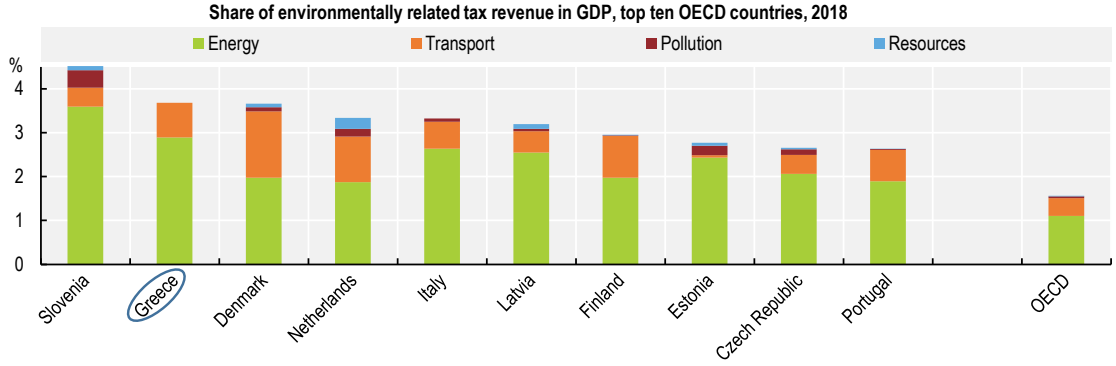
In 2018, Greece renewed its commitment to sustainable development in a voluntary national review on implementation of the 2030 Agenda that was presented at the 2018 UN High-level Political Forum on Sustainable Development (Government of Greece, 2018). Among its eight priorities are strengthening protection and sustainable management of natural capital as a basis for social prosperity and transition to a low-carbon economy. The 2019 National Strategy for Sustainable and Fair Growth 2030 (NSSFG) was expected to guide SDG implementation until an action plan was developed (Government of Greece, 2019).

The NSSFG was a welcome update of the previous growth strategy. It put greater emphasis on sustainable development, climate change adaptation and risk management, while keeping a focus on circular economy and GHG emission reduction. However, the coherence between environmental and economic objectives was not always clear; examples include developing both mega-yacht chartering and eco-tourism, promoting renewable energy resources along with hydrocarbon exploration, and reducing GHG emissions in the transport sector while becoming a leading regional logistic hub. While the new government should partly reconcile environmental and energy ambitions in the updated Growth Strategy, improving environmental-economic accounts would help in understanding and managing the trade-offs between policies. Available information on environmental protection expenditure, the environmental goods and services sector, material flow and natural capital accounts is not sufficient to support policy making.

Carbon prices rose but taxes and charges could be better aligned with environmental objectives while protecting those in need

In 2018, Greece recorded one of the OECD's highest levels of revenue from environmentally related taxes: 3.7% of GDP (Figure 2). The share nearly doubled over the past decade due to increased energy taxation, especially on electricity (to cover the cost of support to renewables) and transport fuels. Greece has some of the highest petrol prices and taxes in the OECD. However, the taxation gap with diesel was among the largest in the OECD in 2018 and has widened since the beginning of the crisis despite diesel's higher carbon and local air pollutant emissions. This, combined with the introduction of CO_2 emission criteria in the circulation tax in 2010 and the end to a ban on diesel cars in metropolitan areas in 2011, helped boost sales of diesel cars.

Figure 2. Greece's share of environmentally related tax revenue in GDP is among the OECD's highest



Source: OECD (2019), "Environmental policy instruments", *OECD Environment Statistics* (database); OECD (2019), "Revenue Statistics: Comparative tables", *OECD Tax Statistics* (database); EC (2019), "Data on taxation", Taxation and Customs Union website.

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Overall, effective tax rates on CO_2 emissions from energy use are high compared with other OECD countries. However, tax variation across fuels and uses, as well as tax concessions, provides inconsistent carbon price signals. Although decreasing, support to fossil fuel consumption accounts for more than

one-quarter of energy tax revenue, among the highest rates in the OECD. This includes tax expenditure compliant with the EU Energy Taxation Directive (e.g. excise tax exemption on specific industrial use of coal and coke and on diesel for aircrafts and vessels, plus reduced excise on oil for heating) and budget transfers (subsidies for oil-based power generators in non-interconnected islands, oil heating allowances to households, capacity payments to gas- and coal-based electricity producers). There is room to improve the monitoring of these direct and indirect subsidies and evaluate their social costs and benefits. In the NECP, the phasing out of fossil fuel subsidies is seen as an effect of the energy transition rather than as an incentive to speed it up. CO_2 emissions are also priced via the EU ETS. The recent rise in allowance prices makes coal-based power costly (Section 4).

Transport tax revenue has decreased, driven by a sharp drop in car registrations. In 2016, Greece introduced a CO_2 component in the registration tax in addition to the Euro emission criteria. This is a welcome step to encourage renewal of the car fleet, which is among the oldest in Europe. However, vehicle tax reductions for old vehicles have helped increase the share of used vehicles in registrations since the recovery of the market in 2013. Greece plans to introduce a distance-based charging system, varying with vehicle emission class, on the motorway network, which would be a cost-effective way to tackle air pollution (van Dender, 2019). Until the system is in place, it could set criteria on local air pollutants in the annual road tax for cars and heavy-duty vehicles. The taxable benefit of using a company car for private purposes has not encouraged employees to drive less and there was no incentive for companies to buy cleaner vehicles or limit their use. The law on Tax Reform, enacted in December 2019, introduces environmental criteria in the tax treatment of personal use of company cars and provides incentives for the use of public transport. While the metro network is being extended in Athens and under construction in Thessaloniki, Greece should further develop incentives to commute by public transport or bicycle. Access restrictions for the most polluting vehicles in Athens and Thessaloniki are not enforced.

Greece is among the few OECD countries that do not raise revenue from other environmentally related taxes (single-use plastic bags is a recent exception). Collecting taxes on landfilling, as provided by the 2019 legislation on waste pricing, would encourage moving up the waste hierarchy (Section 1). There are also opportunities to better reflect environmental and resource costs in water charges, as envisaged by the 2017 law on water pricing, and to address diffuse pollution with taxes on fertiliser and pesticide.

Social tariffs have been introduced to improve the affordability of electricity and water services, but have not been effective in targeting the poorest[6] (Marini et al., 2019). Greece developed an energy poverty observatory, which is a positive step to identify households in need. However, social tariffs distort prices, do not promote efficient resource use and reduce capacity for investment in key infrastructure. They could be replaced with direct payments, not linked to energy or water use, as part of the Social Solidarity Income programme supporting the poorest households since 2017. Supporting renovation of the building stock, as in the Saving at Home programme, and expanding gas central heating would also help alleviate energy poverty.

Effective use of EU funds is key to leverage green investment

In a context of overall decline in investment, environmental protection[7] has been particularly affected (OECD, 2019e). Public investment in waste and wastewater management collapsed during the crisis, rebounded over 2013-15 but has since fallen. EU funds are the main source of public investment. As part of the financial assistance programmes, the co-financing rate of Cohesion Policy programmes over 2007-13 was increased to make the national contribution negligible. Greece spent about 30% of EU funds[8] for this period on roads. Only 13% was spent on environmental protection (mainly for wastewater treatment) and water supply in addition to 12% on energy saving and clean urban transport (EC, 2016). Projects on waste infrastructure, rail and public transport have been delayed by poor planning and limited capacity problems, notably for small municipalities, utilities and other local beneficiaries. Allocations to these areas were increased under the Operational Programme on Transport, Infrastructure, Environment

and Sustainable Development 2014-20[9] to catch up with the backlog from the previous period and address high needs.

Greece should continue to strive to make the best use of EU funds to meet environmental goals. Investment worth EUR 1.6 billion is needed to ensure that urban wastewater is properly collected and treated (EC, 2019a). While nearly EUR 1.5 billion in EU funds is allocated to water and wastewater management over 2014-20[10], projects have been delayed by the late adoption of the laws on water pricing and public procurement and the second round of River Basin Management Plans. Combined with a new system for benchmarking water utilities, these measures should help prioritise investment, improve water provision sustainability and enhance accountability and co-ordination of the sector (EC, 2019b).

Greece is actively promoting public-private partnerships in waste management, combining private capital and Cohesion Policy funds (European Parliament, 2017). However, investment in residual waste treatment seems too high, compared with investment in separate collection, sorting and recycling infrastructure (EC, 2019a). High operational expenditure on waste management (0.5% of GDP in 2016-17) is not reflected in the performance of services provided by municipalities, highlighting the need to better control costs.

Most GHG emission reductions to 2030 are expected to come from development of renewables-based electricity and energy efficiency improvement (Section 4). Related investment needs are estimated at more than 2% of 2018 GDP annually. As in other OECD countries, overly generous feed-in tariffs and decreasing costs have supported impressive growth in solar and wind power generation capacity, but changes in support policy have discouraged solar photovoltaic investment. In addition to a recent feed-in premium system, developing renewables will require investing in the grid to interconnect islands with the main network, where cost-effective, and in hybrid systems with energy storage technology for smaller islands (IEA, 2017). There is significant potential to improve energy efficiency in buildings, most of which were built without insulation. Beyond effective use of EU funds, developing private funding through energy performance contracts, as planned by the NECP, can help overcome limits on access to bank loans (Section 4).

The motorway network has doubled over the past decade. In 2017, investment in roads accounted for 2.3% of GDP, a higher share than in any other OECD country. This contributes to better connectivity and growth but does not support long-term climate targets. The shares of rail in passenger and freight transport are among the lowest in the EU. Despite significant funding to extend public transport systems, a lack of sustainable urban mobility plans and poor development of soft transport modes have resulted in continued reliance on cars. While the National Transport Plan 2019-37 projects increased investment in rail infrastructure, expected growth in transport activity means the dominance of road in the modal split is not expected to change significantly (MIT, 2019).

Developing markets and innovation in circular and low-carbon economy require better monitoring and targeting

Despite significant progress in recent years, Greece's eco-innovation performance is modest, ranking in the bottom third of EU countries in 2017 (EC, 2019c). The government research and development (R&D) budget on environment has increased since 2012 but the trend on energy is unclear (OECD, 2019f). While an information system is in place for public-funded R&D projects, there is no inventory of private spending on energy-related R&D or on beneficiaries and outcomes that would allow assessment of the technological outlook in the sector (IEA, 2017). In a context of limited green patent applications, those related to climate change mitigation (mostly energy generation, transmission and distribution) have been declining.

Important demonstration projects have been achieved thanks to EU research programmes. For example, Tilos island is now fossil-fuel free thanks to a pioneer hybrid system combining renewables and energy storage technology. Environmental issues, energy and transport are among the eight priorities[11] of the 2015 National Research and Innovation Strategy for Smart Specialisation 2014-2020, which has been

allocated EUR 1.1 billion in EU funding. However, there is a need to focus investment on Greece's strengths and long-term needs. The 2018 Circular Economy Strategy, 2019 NECP and long term mitigation strategy provide opportunities to develop a coherent approach on eco-innovation.

More efforts are needed to monitor the transition to a circular and low-carbon economy. There is insufficient information on the environmental goods and services sector. While waste management accounts for a high share of total value added, circular economy sectors[12] are underdeveloped compared with other EU countries. In 2017, the renewables industry provided employment for 25 000 people, twice the upper-bound estimate of coal-related jobs (EurObserv'ER, 2018) (Alves Dias et al., 2018). The NECP expects to create nearly 60 000 full-time jobs in the renewables and energy efficiency sectors (MoEE, 2019). National statistics need to be improved to support reallocation of labour from shrinking to growing activities.

Fragmented R&D policies, limited research activity, weak business participation and limited co-operation between academia and business are barriers to eco-innovation (MoEE, 2019) (EC, 2018b). The policy mix is mainly composed of financial R&D support while demand-side instruments, including regulations, standards and certification, are undermined by weak enforcement of environmental policies. GPP uptake is low (Section 2).

Box 3. Recommendations on green growth

Framework for sustainable development and green growth

- Adopt the national SDG implementation plan and ensure coherence with the revised Growth Strategy and its future updates.
- Further develop environmental accounts (environmental protection expenditure, environmental goods and services sector, material flow and natural capital accounts) and promote their use in policy making.

Greening the system of taxes, charges and prices

- Review tax variation across fuels and uses to provide a consistent carbon price signal. Gradually close the gap between diesel and petrol taxes.
- Establish an institutional mechanism to assess the environmental effects of fiscal instruments, identify subsidies with adverse environmental effects and prioritise which to phase out.
- Harmonise the taxation of new and old vehicles. Vary the circulation tax by air emission standards in addition to CO_2 until road tolls are linked to vehicle emissions. Enforce access restrictions for the most polluting vehicles in metropolitan areas.
- Continue to improve information on energy poverty to better target assistance and assess the cost-effectiveness and environmental impact of such assistance. Consider replacing social energy and water tariffs with direct payments (not linked to energy or water use) as part of the Social Solidarity Income.

Investing in the environment to promote green growth

- Ensure effective use of EU funding for environment-related infrastructure by strengthening beneficiaries' administrative capacity for management of the funds, improving project planning and co-ordination, reinforcing public procurement procedures and supporting municipalities in implementing investment plans.
- Improve the accountability and co-ordination of actors in the water sector. Further assess utilities' performance to ensure that water prices cover the cost of service provision and reflect environmental and resource costs.
- Align waste investment with circular economy objectives. Establish a system to assess municipalities' performance in providing waste services.
- Rebalance investment from road to rail. Implement sustainable urban mobility plans and develop soft transport modes.

Promoting eco-innovation and environment-related markets

- Strengthen energy research and promote eco-innovative technological solutions in the framework of Smart Specialisation Strategies. Focus investment on the R&D activities with the highest social return.

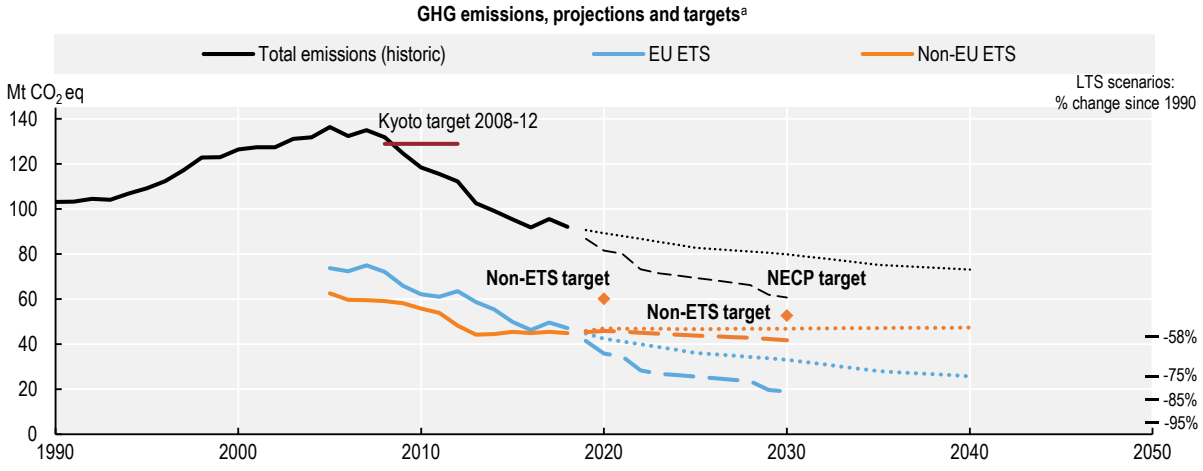
1.4. Climate change mitigation and adaptation

Climate neutrality requires effective implementation of ambitious policies

GHG emissions fell by 33% between 2005 and 2018. Greece achieved the second largest decline in the OECD over 2005-17. The financial and economic crisis, which reduced energy demand, explains much of the decline, although a shift from coal and oil towards natural gas and renewable resources also played a role. 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 3). GHG emissions not covered by the EU ETS decreased by 28% between 2005 and 2018, putting Greece on track to meet its targets to reduce related emissions by 4% by 2020 and by 16% by 2030.

Greece's emission profile is similar to that of most other OECD countries, with most emissions coming from energy use, notably power generation and transport. The LULUCF sector is a small net sink. Per capita emissions are below the OECD average. However, the economy's carbon intensity is high owing to significant reliance on lignite for power generation and on oil for transport, heating and power generation on many islands. Greece does not use nuclear energy and is not considering this option. Lignite, which is particularly carbon intense, is the only significant domestic fossil fuel. Even though lignite use has declined, in line with climate targets, it still accounted for one-fifth of energy supply and one-third of electricity generation in 2018 (IEA, 2019).

Figure 3. Greece adopted ambitious targets for 2030 but the transition to climate neutrality is challenging



a) GHG emissions excluding land use, land-use change and forestry.
Notes: 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.
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*.

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In December 2019, the government endorsed an NECP with more stringent targets for 2030 than the EU requirement (MoEE, 2019). Greece should be commended for increasing its ambition, in line with the Paris Agreement. The NECP expects that emissions will decline primarily due to falling emissions from power generation, and that emissions in non-EU ETS sectors will slightly decrease from today's level mostly

thanks to energy efficiency measures in the residential sector (Figure 3). Emissions from transport are expected to decline only moderately.

Greece has also developed a Long-term Strategy to 2050 reviewing possible evolution of the energy system to bring the economy to a long-term net-zero emission pathway by mid-century (MoEE, 2020). According to projections, should the country achieve its 2030 goals, additional measures will need to be implemented. Continuation of NECP measures beyond 2030 would reduce total GHG emissions by 58% from 1990 levels by 2050. The expected intensification of these measures would lead to a 75% reduction.

Trajectories in individual non- EU ETS sectors could be further detailed

The merger of the energy and environment ministries in 2009 raised the profile of climate change and facilitated integration of climate change, energy and air pollution policies, as recommended by the 2010 EPR. The MoEE now bears the main responsibility for national climate change mitigation and adaptation activities, while line ministries are responsible for implementing climate action in their areas. Inter-ministerial committees aim to facilitate collaboration among ministries and stakeholders. About one-third of Greek cities have developed climate change action plans through the Mayors for Climate and Energy initiative; several of them also cover adaptation activities.

Climate-related targets and goals are largely set by EU legislation. The NECP, which integrates climate objectives and energy planning up to 2030, is the most comprehensive document outlining how Greece plans to meet its mitigation commitments. It puts particular emphasis on the energy and energy-related sectors. However, mitigation policies in sectors other than energy could be further detailed (agriculture, LULUCF, transport, waste). In addition, Greece should specify options to enhance the LULUCF sink to achieve its long-term goal of carbon neutrality.

Greece's GHG emission reporting complies with EU requirements and guidelines and those of the UN Framework Convention on Climate Change. Reports on mitigation efforts and progress made towards climate-related targets (e.g. on renewables and energy savings) are published regularly, in line with EU requirements. Nevertheless, oversight of climate policy development and implementation could be strengthened. Emission reduction trajectories of individual non-EU ETS sectors could be specified to ensure accountability in these sectors.

Most emission reductions are expected to come from the shift to renewables

Mitigation efforts are focused on decarbonising energy industries, which accounted for 42% of national GHG emissions in 2017. The NECP sets an objective to diversify the energy mix and reduce its CO_2 intensity while increasing energy security and making the sector more competitive. The NECP aims to reduce emissions in non-EU ETS sectors by 36% compared to 2005 levels, to reach a renewables share of at least 35% in gross final energy consumption and to limit final energy consumption to 16.5 million tonnes of oil equivalent by 2030. Most emission reductions are expected to be achieved through promotion of natural gas and renewables, interconnection of islands with the mainland grid and faster decommissioning of lignite power units.

Greece has seen remarkable growth in renewables. Their share in electricity generation increased from 11% in 2005 to 31% in 2018. This increase was driven by a boom in solar and wind that was supported by generous feed-in tariffs, lower technology costs and simplified licensing and permitting. In 2016, a feed-in premium programme was put in place to replace a feed-in tariff system that had become too costly, as in other OECD countries. Since 2018, the aid has been granted to specific solar photovoltaic and wind installations that have successfully participated in competitive bidding processes. The feed-in premium is more market-oriented than feed-in tariffs and should help bring down public support costs. The feed-in premium and auctions are considered the most important policy measures supporting renewables through 2030. To encourage decentralised renewables-based power generation, Greece is 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.

Interconnection of islands to the mainland electricity grid is a government priority that has considerable potential to foster renewables development, reduce emissions of GHGs and other air pollutants and increase energy security. Despite high renewables potential, the lack of storage systems results in many islands relying on diesel generators, which are both expensive and environmentally undesirable. Investment in renewables-based electricity generation combined with battery storage is the preferred alternative when interconnection is not cost-effective. Other priorities of the NECP include implementing the new electricity market model[13] to facilitate participation of renewables, improving the licensing system and revising the spatial plan for renewables.

Stricter EU emission standards and increasing CO_2 prices under the EU ETS make lignite-fuelled power generation increasingly expensive. The NECP outlines a roadmap for decommissioning all currently operating units (3.9 GW) over 2019-23. Ptolemaida V (0.7 GW), under construction, will be the only lignite power plant in operation beyond this date. Adjustments are being studied to fire it with other fuels by 2028 (energypress, 2019). As the new plant will need to acquire emission allowances under the EU ETS, there is a risk of it not being profitable without additional subsidies. Greece is starting to address the impact of the clean energy transition on lignite-producing areas through its engagement in the EU Coal Regions in Transition initiative and its Fair Transition Fund, which since 2018 has redistributed some revenue from EU ETS allowances to development activities in coal-dependent areas. Developing a Just Transition Plan will allow the country to get access to funding from the recently launched EU Just Transition Mechanism.

Improving energy efficiency should be a priority. Efficiency improvement was modest over the review period, as the economic situation, lack of funding and insufficient data limited the effectiveness of implemented measures. The establishment of energy audits (2016) and an energy efficiency obligation (EEO) programme (2017) are important steps in the right direction. The EEO programme is in pilot phase but could be strengthened for its second implementation period, starting in 2020. While Greece is on track to meet its 2020 energy savings targets, its 2030 target seems to require limited additional saving (-1.8%) compared to 2017 final energy consumption. There is potential for Greece to improve efficiency in its building stock. The NECP proposes improving the energy performance of between 12% and 15% of the current building stock by 2030, which corresponds to 60 000 buildings renovated annually until 2030. The 2018 long-term 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.

Transport's contribution to mitigation is expected to be relatively small, even though the sector accounts for nearly 20% of GHG emissions. Most reductions are expected to be achieved through increased use of biofuels. The NECP sets a target for electric passenger cars to reach a 30% share of new registrations by 2030, which is challenging given the limited deployment of such cars to date (0.3% of new cars sold in 2019). An Inter-ministerial Committee has been mandated to develop an operational electro-mobility development plan by 2020. Mitigation potential also lies in promotion of electric powering of docked ships. The NECP includes projections but no overall target for emission reductions in transport; a lack of information on estimated quantified emission reduction from envisaged measures limits transparency and accountability for climate action in the sector. Coherence with the National Transport Plan should be ensured.

Greece is highly vulnerable to climate change effects and should continue pursuing adaptation efforts

As a Mediterranean country with thousands of islands, Greece is highly vulnerable to the impact of climate change (Barros, 2014). It has already experienced rising mean temperatures and changes in precipitation levels and is prone to extreme climate events such as heatwaves, fires (including a deadly 2018 event)

and floods (Bank of Greece, 2011). By the end of the century, the decrease in precipitation levels is estimated to range from 5% to 19% countrywide while air temperature is projected to increase by between 3.0ºC and 4.5ºC. Sea level rise and freshwater shortage are the priority risks. Sea level rise is projected between 0.2 to 2 metres by 2100, rendering 1 000 km of Greece's 18 400 km of coastline highly vulnerable to climate change.

To prepare for these risks, Greece has improved the evidence base on potential impact and vulnerability. The Bank of Greece published a comprehensive study with detailed climate projections and models of the environmental, social and economic impact. The study concluded that, without action, climate change may reduce GDP by up to 2% per year by 2050 and up to 6% by 2100.[14] Agriculture is among the sectors expected to be hardest hit, but the impact on tourism and coastal areas will also particularly affect household income as well as the economy as a whole (Bank of Greece, 2011). An update of the study is envisaged for 2021. In addition, a geospatial database including climate data, maps and projections for the 13 regions is expected to be released online in 2020.

Greece has strengthened its policy and institutional framework for adaptation. The National Adaptation Strategy was formally endorsed through Law 4414/2016 (MoEE, 2016). It sets out general objectives, principles and implementation tools for adaptation and lists potential measures for 15 priority sectors identified in the Bank of Greece study. It does not provide for a national adaptation action plan. Instead, the 13 regions are expected to develop regional action plans, taking into account their circumstances and needs, to operationalise and implement the national strategy. The regional plans are required to identify local impact and vulnerabilities, prioritise actions based on their cost-effectiveness, identify synergies with other policies (e.g. land use), outline budget needs and potential finance sources, and include a mechanism to monitor progress. The relatively significant responsibility assigned to regional governments necessitates capacity building and cross-government co-ordination to align actions and share information and knowledge. A National Climate Change Adaptation Committee acts as the formal co-ordination and advisory body at the national level for adaptation policy monitoring, evaluation, formulation and implementation. It has been convened only once to date, however.

Progress has been made in considering adaptation in sector strategies, such as the National Biodiversity Strategy, the National Strategy for Forests, the Maritime Spatial Planning Law and the National Research and Innovation Strategy for Smart Specialisation. There is room, however, to clarify how the various objectives interact. The NECP, for example, 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 the plan will make the energy system more resilient. Plans call for such an analysis to feed into the 2023 NECP update. Implementation of adaptation measures in agriculture and water management plans remains to be assessed.

The Greek authorities expect the regional action plans, which will include sectoral activities, to facilitate integration of adaptation considerations. Once the plans are finalised, the MoEE will assess whether additional action is needed at the national level. While this bottom-up approach reflects and accounts for regional circumstances, it may delay national-level action, notably in sectors considered highly vulnerable (e.g. agriculture, tourism). It may also miss cross-cutting risks (e.g. concerning water, infrastructure, energy) and risks that go beyond regional boarders (e.g. regarding coastal zones, health). Nevertheless, the first results of the regional risk assessments, expected in June 2020, will provide a useful basis to inform national-level action. While climate resilience is considered in EIA, it is not explicitly mentioned in the national legislation on SEA (EC, 2018c).

Greece has yet to establish a monitoring and evaluation framework that would track integration of climate risk in sectoral policies, as well as the implementation and effectiveness of adaptation actions. It plans to develop a national framework in 2020, however, learning from other OECD countries such as Austria, Finland, Germany, Spain and the United Kingdom. There is also a need to build capacity and disseminate knowledge. The national adaptation committee could play a role in advising and supporting regional

governments in developing their plans, identifying knowledge and action gaps at the sectoral level and establishing a monitoring and evaluation mechanism. 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.

Box 4. 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.

1.5. Biodiversity conservation and sustainable use

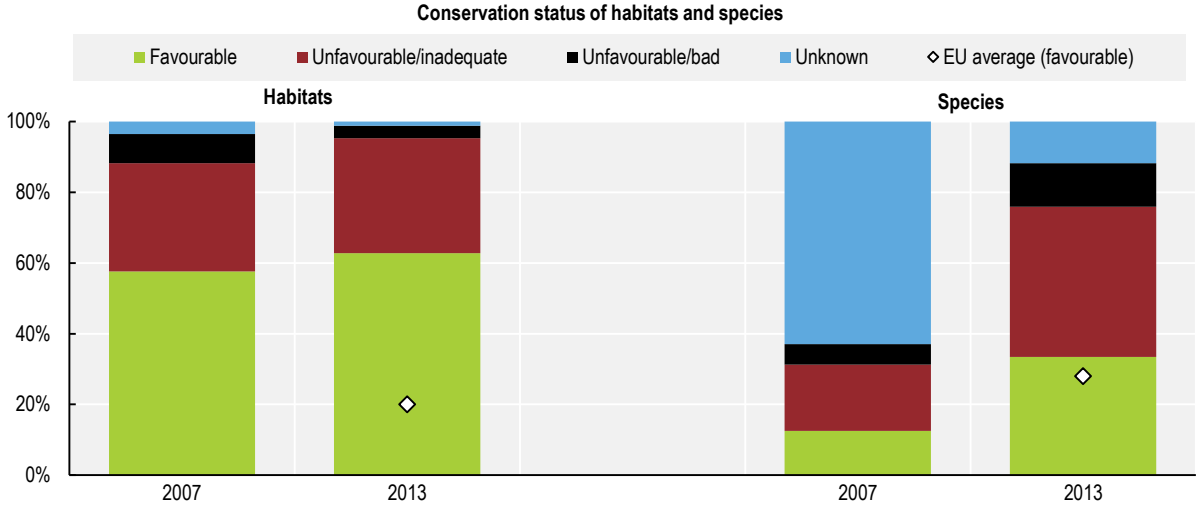
Pressures on biodiversity stem from key economic sectors

Greece is home to abundant European and Mediterranean flora and fauna, including a large number of endemic species, and a wide variety of ecosystems and habitats, many of which are of international interest.

The conservation status of habitats has improved in recent years (63% have favourable status), but more than half of species (55%) are in an unfavourable state (EC, 2019a). The main causes of biodiversity loss in Greece are natural system modifications, including urbanisation and habitat fragmentation, pollution,

invasive alien species, climate change and fires. Key pressures come from agriculture, fisheries, transport and tourism (especially coastal).

Figure 4. The conservation status of habitats and species has improved



Source: EEA (2019), *Habitats of European Interest* (database); Eionet (2019), *Reporting under Article 17 of the Habitats Directive*.

StatLink https://doi.org/10.1787/888934155269

Greater effort to improve biodiversity is urgently required in light of rising pressures, many of which stem from policies outside the purview of the MoEE, such as fisheries, agriculture and tourism.

The legal framework meets international commitments, but further efforts are needed to establish a more comprehensive approach to monitoring

Since the last EPR, Greece has made notable progress in improving its legal biodiversity framework. It issued important laws on biodiversity conservation (2011) and on management bodies of protected areas (2018). In 2017, the Natura 2000 network was expanded, especially with regard to marine areas, albeit starting from a low base, in order to address gaps in protected marine habitats and species.

The National Biodiversity Strategy and Action Plan (NBSAP, 2014) provides a solid framework with detailed targets and sub-targets to improve knowledge and the status of biodiversity and mainstream it into sectoral policies. Preparation of the new action plan beyond 2019 offers an opportunity to assess achievements and address remaining challenges, including updating the 2009 red list of threatened species.

Despite positive ad hoc initiatives aimed at filling data gaps, Greece has not yet established a comprehensive national monitoring system for biodiversity. The NBSAP includes targets for monitoring and evaluating its implementation, which should facilitate access to scientific knowledge regarding Greek flora and fauna and fill remaining data gaps.

For biodiversity protection, Greece prefers regulatory approaches

As in many OECD countries, protected areas are the main regulatory instrument to protect biodiversity. According to national data, they cover an extensive share of terrestrial areas (32%), while marine protected areas account for 20%15 of territorial sea. Greece has thus largely achieved the 2020 Aichi target 11. To date few protected areas have management plans. The current objective is to develop management plans for all protected areas by 2022. Additional obstacles to effective management of protected areas are insufficient funding, especially in light of the expansion of territorial responsibilities under the 2018 law establishing management bodies for protected areas, and lack of capacity and awareness among

authorities and the public (EC, 2019a). Capacity building and awareness raising are being done through LIFE Integrated Project LIFE-IP 4 NATURA, which should boost overall efforts.

Greece lacks an overarching framework for green infrastructure, which is also an NBSAP sub-target and a target of the EU 2020 Biodiversity Strategy. Further integration of biodiversity concerns into spatial planning would go a long way towards reducing illegal activities harmful to biodiversity and ultimately ensuring sufficient protection of habitats and species. There is not yet any legally binding national maritime spatial plan (EEA, 2019b), but Greece plans to develop its National Maritime Spatial Strategy in 2020. Economic instruments related to biodiversity are underused.

Mainstreaming biodiversity into economic sectors is an opportunity to balance trade-offs

Greece needs to better mainstream biodiversity into economic sectors by making explicit links between ecosystem services, biodiversity conservation and sustainable resource use in key policy areas. NBSAP target 5 indicates the need to enhance synergies among the main sectoral policies for biodiversity conservation. The eight sub-targets focus on integration of biodiversity considerations into key sectors such as tourism, agriculture, fisheries and forestry.

As tourism expands in Greece, it will be increasingly important to create links between this sector and national biodiversity priorities. Tourism significantly contributes to the Greek economy in terms of direct GDP and employment, shares of which are among the largest in the OECD. The strongest environmental impact of tourism occurs in coastal areas due to infrastructure, including roads leading to tourist destinations, and overcrowding on beaches. The NBSAP includes actions to achieve the sub-target on compatibility of tourist activities with biodiversity conservation. To date, however, it is unclear where Greece stands with respect to this target. The development of the National Maritime Spatial Strategy in 2020, along with the updated Spatial Planning Framework for Tourism, could lead to more effective management of coastal and marine areas.

NBSAP actions related to mainstreaming biodiversity into agriculture are not very specific; they refer to improving sustainable management of agricultural ecosystems. Biodiversity mainstreaming into agriculture is mostly done through the Rural Development Programme (RDP). However, the net effects of agri-environmental measures of the RDP on biodiversity would require a more detailed assessment to improve their effectiveness under the next RDP. Unlike in other countries, there are no quantitative national targets on organic farming. The organic share in agricultural area increased from 7% in 2005 to 9% in 2018, above the 2017 OECD average (7%) (OECD, 2019g). It has grown less rapidly than in most countries despite significant EU support.

Fish stocks in 2015-16 indicated overfishing of hake in the Aegean Sea, while other species remained stable or increased (OECD, 2017b). Mainstreaming of biodiversity into fisheries is mainly done through regulatory instruments, including banning of drift nets and of pelagic trawling, and restricted areas for fish juveniles. In addition, fishing is restricted in certain areas to conserve marine habitats and protect endangered aquatic organisms. NBSAP targets include revising the regulatory framework for fisheries, based on conservation needs of species and habitat types, and enhancing port authorities' ability to control illegal recreational fishing.

A National Forest Strategy was adopted for 2018-38. It identifies specific objectives as well as the necessary resources and means of implementation. It also endorses the Mediterranean forestry model in Greece's management of forest ecosystems, which aims at strengthening their multifunctional role. However, national data gaps on forestry make it difficult to determine forest cover and intensity of use. As of 2019, forest maps had been drafted for most of the country, and the objective is to complete the mapping by the end of 2020.

Box 5. Recommendations on biodiversity conservation and sustainable use

Improving biodiversity data and information

- Continue to improve knowledge of the extent and value of ecosystem services, habitats and species within and outside protected areas. Complete the mapping and assessment of ecosystem services, in co-operation with all relevant stakeholders and in line with commitments under the Convention on Biological Diversity and the EU 2020 Biodiversity Strategy. Update the red list of threatened species.

Implementing effective policy instruments

- Complete management plans for all protected areas, with legal force and sufficient resources for implementation. Ensure consistent and effective implementation of existing plans. Create ecological corridors to reduce fragmentation.
- Support municipalities in effectively implementing local spatial plans that integrate biodiversity considerations. Develop a strategic policy framework for green infrastructure.
- Identify the priority research and data gaps that need to be filled to better prevent and manage the spread of invasive alien species.

Mainstreaming biodiversity in tourism, agriculture, fisheries, forestry

- Promote the use of relevant indicators and frameworks for infrastructure development to reduce or mitigate the impact of tourism and related infrastructure on biodiversity. Monitor progress towards the relevant NBSAP actions. Support sustainable tourism initiatives and promote thematic forms of tourism in line with protection and conservation of resources. Consider expanding financing sources, including visitor fees to protected areas and fees for tourism operators.
- Provide training and technical assistance to farmers to better implement agri-environmental measures under the RDP so as to reduce pressures on biodiversity. Increase the share of organic farming.
- Introduce additional measures to improve the sustainability of fisheries, including expanding management plans for overexploited species and special habitats. Revise the regulatory framework for fisheries, in accordance with the NBSAP.
- Upgrade the national forestry accounts. Explore opportunities to increase the use of economic instruments for forest conservation, such as payments for ecosystem services, while introducing sustainable management certifications for forestry and derived products.

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Notes

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

[2] The programme was due by April 2019 according to 2016/2284/EU.

[3] As of mid-2018, 14 illegal landfills were still in use, 24 sites were not in use but had not been restored, and 19 had been restored but not fully closed in accordance with the legal framework.

[4] Only 19% of pesticide application equipment had been inspected by early 2018 while all equipment should have been tested by 2016 under the Sustainable Use of Pesticides Directive (2009/128/EC).

[5] Partly due to more active substances being detected.

[6] In 2018, less than half of Social Solidarity Income recipients took advantage of social tariffs on electricity and 10% benefited from social tariffs on water.

[7] Including the following domains of the Classification of the Functions of Government: waste and waste water management, pollution abatement, protection of biodiversity and landscape, and R&D related to environmental protection.

[8] Cohesion Fund and European Regional Development Fund, after decommitment and correction.

[9] EUR 4.6 billion budget excluding national contribution. Environment and transport each account for half of the budget.

[10] Under the various operational programmes.

[11] Agrofood; life sciences and health – pharmaceuticals; information and communication technologies; energy; environment and sustainable development; transport and logistics; materials – construction; culture – tourism – cultural and creative industries.

[12] The waste recycling sector, repair and reuse sector and rental and leasing sector.

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

[14] The Bank of Greece study estimated that a mitigation scenario would cut this by 40% and an adaptation scenario by 20%.

[15] Using harmonised international data for the denominator, the percentage of marine protected areas in Greece is less than 5% (OECD, 2019h).

Annex 1.A. Actions taken to implement selected recommendations from the 2009 OECD Environmental Performance Review of Greece

Recommendations	Actions taken
Chapter 1. Environmental performance: trends and recent developments	
Strengthen the analytical basis for decision-making, including *environmental data*, and *economic information* on the environment (*e.g.* environmental expenditure, environment-related taxes, resource prices, employment).	Despite progress such as the establishment of registries on waste generation and water abstraction, there is room to strengthen the analytical basis for policy making. For example, available data do not allow inference of trends in water abstraction or assessment of hazardous waste generation (Chapter 1). Progress on environmental accounts is slow (Chapter 3).
Further *reduce air emissions*, especially SO_2 emissions from electricity generation (e.g. lignite fired power plants) and VOCs emissions from transport, so as to meet national emission ceilings; strengthen the *monitoring and management of particulate matter* (including $PM_{2.5}$) *and ground level ozone*.	Since 2009, emissions of major air pollutants have decreased faster than economic activity (Chapter 1). Reduction in energy consumption, abatement measures such as flue gas desulphurisation, changes in the electricity mix, reduction of fuels' sulphur content and scrapping of old vehicles have been the main drivers of this decline. Greece met its 2010 emission reduction commitments under the National Emission Ceilings Directive except in the case of NO_X. According to national projections, the country is on track to meet its 2020 and 2030 targets. The National Air Pollution Monitoring Network needs further improvements to increase the accuracy of exposure estimates.
Address *air pollutant emissions from ships*, *e.g.* taking measures to improve vessel performance and fuel quality.	Greece transposed into national law the revised Annex VI to MARPOL (Protocol of 1997 to amend the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto) containing regulations for the prevention of air pollution from ships and Directive 2016/802/EU relating to a reduction in the sulphur content of certain liquid fuels. As of 2020, Greece has to ensure that ships use fuels with a sulphur content of no more than 0.5%. In 2018, the port of Killini undertook the first cold ironing pilot in the eastern Mediterranean, paving the way for wider implementation (Chapter 1).
Continue efforts to fully comply with the *EU Water Framework Directive*.	In 2017, Greece adopted its second round of River Basin Management Plans (RBMPs) under the Water Framework Directive (WFD) after a two-year delay.
Formulate and implement a *national irrigation policy*, integrating agronomic, water and environmental policy objectives, which promotes the rational use of water, aims to reduce groundwater abstractions and to improve irrigation efficiency and practices in both communal and private irrigation networks, and ensures that all water abstractions are properly licensed	The Rural Development Programme (RDP) is the key agricultural policy framework. Its environmental objectives include the rational use of water and the enhancement of irrigation efficiency and practices. However, ascertaining the net effect of RDP agri-environmental measures to address water pollution and abstraction would require a more detailed assessment (Chapter 1). According to Ministerial Decision 146896/2014, issuance of a permit for water use or exploitation works is subject to availability of the necessary water quantity as evidenced by the relevant RBMP. A national register of water abstraction points was established in 2014. A law (JMD 135275/2017) sets the rules for pricing water services and recovering the costs of water services for various uses.
Further *improve wastewater management*, in compliance with the EU Urban Waste Water Directive, and consider the wastewater treatment needs of smaller settlements; encourage utilities to improve water quality assurance (*e.g.* through participation in international benchmarking).	Greece has made progress in wastewater treatment in large agglomerations. However, 10% of the wastewater load is dealt with by individual systems, which should be replaced by collecting systems and treatment plants where population density is high enough (Chapter 1). Investment amounting to EUR 1.6 billion is needed to ensure that urban wastewater is properly collected and treated. A national registry of urban wastewater treatment plants was established. Guidelines are available on management of sewage from small settlements (less than 2000 inhabitants).
Intensify efforts to *reduce water pollution* by dangerous substances, to prevent illegal discharges of wastewater, and clean up pollution hot spots.	RBMPs include programmes of measures to address point source and diffuse water pollution. Legal provisions have been provided for individual river basin districts, e.g. setting water quality standards and emission limits in the Asopos River basin. However, more data is needed to characterise river basins and address pollution issues.

Introduce new measures to improve the *allocation of water* to ensure water flows to the highest-value uses.	Economic analysis in the RBMPs takes water resource cost into consideration. A 2017 law provides for cost recovery in water services but there is room to better reflect financial, environmental and resource costs with water charges (Chapter 3). In 2019, an information system was set up to monitor water utilities' operational and financial performance.
Raise greater *public awareness and understanding*, particularly among farmers, of the economic, social and environmental aspects of water management.	RBMPs include actions to increase public awareness and understanding of sustainable water management (e.g. information meetings on new technologies, modern irrigation techniques, environmental protection issues, fertility of land). The RDP includes educational programmes and awareness actions.

Chapter 2. Environmental governance and management

Utilise fully the *institutions on sustainable development* now in place to ensure the implementation of the revised National Strategy for Sustainable Development; continue focusing sector integration and sound long-term planning with a view to achieve a low-carbon, energy and material efficient economy.	Protection and sustainable management of natural capital and transition to a low-carbon economy constitute one of eight national priorities related to implementation of Sustainable Development Goals (SDGs). Over 2017-19, the General Secretariat of the Government played a key role in ensuring a whole-of-government approach to implementing SDGs. The Inter-ministerial Co-ordination Network for the SDGs brings together focal points of all line ministries responsible for mainstreaming SDG-related issues into sectoral legislation, policies and programmes. Since 2019, the Presidency of the Government has been in charge of monitoring and co-ordinating SDG implementation.
Further strengthen the visibility, human and financial resources, and influence of the environmental administration at all levels.	Key environment-related functions of the central government are concentrated in the Ministry of Environment and Energy (MoEE). The 2009 merger of the environment and energy ministries increased the influence of environmental administration and raised the profile of climate change policies. The decentralised administrations have general directorates for spatial and environmental policy and for forestry and agriculture. Every regional authority has a directorate for development planning, environment and infrastructure. Although central, regional and local government responsibilities are defined legislatively, their practical division is not always clear, leading to implementation gaps or overlap.
Streamline the *administrative procedures* associated with environmental impact assessments and the application for planning and building permits; reduce building and housing *construction without prior planning*.	The 2011 Law on Environmental Permitting and over 25 related regulations combined the EIA and permitting processes and significantly modified EIA requirements. The reform also incorporated hazardous and non-hazardous waste management and wastewater discharges, which previously were permitted separately, into the Approval of Environmental Terms, an integrated environmental permit issued according to a uniform process. The introduction of standard environmental obligations for low-impact facilities that previously required a permit and the quasi-elimination of preliminary environmental assessment for large projects significantly reduced the number of EIA cases and the average time to complete the permitting procedure. A new spatial planning framework for marine and coastal areas was adopted in 2018, a National Maritime Spatial Strategy is expected in 2020, and maritime spatial plans are to be completed by 2021. However, Illegal construction, including in coastal and forest areas, remains a concern.
Ensure adequate control and strict enforcement of the existing legal framework regarding *construction without prior building permit.*	Law 4495/17 defines measures to prevent illegal construction (e.g. prohibition of real estate transactions with illegally constructed buildings or connecting them to utility networks). Fines for illegal construction have increased. However, Law 4495/2017 on the Built Environment preserved certain conditions for retroactive legalisation of illegal housing development.
Complete the *National Cadastre and the National Forest Registry* as soon as possible.	The authorities have committed to complete the cadastre and an associated land register by mid-2021. As of 2019, forest maps had been drafted for most of the country and Greece intends to fully establish the cadastral agency and complete 45% of the cadastral mapping by mid-2020.
Implement plans to strengthen the financial and human resources devoted to the new environmental inspectorate; continue to promote *compliance with and enforcement of environmental and land-use regulations*.	The Hellenic Environmental Inspectorate, initially a separate service, joined the MoEE's other inspection services (for mining, energy and building activities) in 2014 and became part of the ministry in 2017. However, the number of environmental inspectors at the central level fell from 35 in 2011 to 15 in 2018. The number of inspections at the national level thus declined from 313 in 2008 to 88 in 2018. The publication in 2017 of the country's first five-year national environmental inspection plan (2018-22), covering all 21 national and regional environmental inspection authorities, is a positive development. However, in 2018 the central inspectorate carried out only 43% of its target inspection load and the regional authorities 24%.
Adopt and implement the proposed Framework Plans for *Coastal Areas and Islands* and for *Mountainous Areas*; set up a transparent monitoring system to *track*	A new spatial planning framework for marine and coastal areas was adopted in 2018, and maritime spatial plans are expected to be completed by 2021. Revised Regional Spatial Planning Frameworks (for 8 out of 13 regions) have been broadened to include

and report on the effectiveness of the Frameworks for Spatial Planning and Sustainable Development.	protection of coastal areas. Evaluation of all regional spatial planning frameworks has been completed. Evaluation of sectoral-specific spatial planning frameworks is under way.
Continue efforts to collect, process and disseminate *environmental information* at national and territorial government levels.	A dedicated 2011 law promotes e-governance in public administration, which facilitates online access to information. A 2015 presidential decree codified regulations on access to public documents and data, including environmental information. All public authorities are required to upload every administrative act on the Diavgeia (Clarity) website as a result of a major initiative by the Ministry of Interior. The MoEE has launched a first version of the National INSPIRE Geoportal. The latest State of the Environment Report was published in 2018 by the National Centre for the Environment and Sustainable Development. However, the absence of a coherent framework for data collection, classification and maintenance remains a key barrier to accessibility and adequate interpretation of environmental information.
Continue to encourage more active *public participation associated with decision-making*, as well as effective implementation of provisions for access to environmental justice and follow-up to judicial decisions; enhance the effectiveness of consultation procedures.	Public participation in EIA and environmental permitting for category A1 and A2 activities, in SEA and in river basin management and other planning is mandated by law. Relevant documents are posted for comment on websites of competent authorities and/or the open government portal (www.opengov.gr). The law requires government authorities to consult the public on draft legislation before its submission to the parliament. Consultation on presidential decrees and ministerial decisions can also take place but is not mandatory. Greece guarantees broad access to justice on environmental matters for individuals and NGOs. Citizens can invoke the right to a clean environment, provided in Article 24 of the Constitution, as the basis for suits in administrative or regular courts. However, there are no special judicial procedures for environmental matters, and court procedures are very long.
Take further steps towards the integration of environmental themes at all stages of *education*, including professional training.	Greece has integrated environmental aspects in education at all levels. The Institute of Educational Policy developed the curriculum on environment and sustainable development, approved in 2015. About 80% of primary and secondary schools participate in sustainability initiatives. The majority of Greek universities have introduced environment-related subjects in their curricula. However, there is limited financial support for environmental education, leading to a lack of technical infrastructure and specialised staff.
Raise *awareness and understanding of sustainable development* among the major stakeholder groups and in the Greek society at large.	Fifty-three Environmental Education Centres support schools in designing and using sustainability curricula that go beyond the purely environmental dimension, and will provide teachers with training and promote sustainability initiatives in collaboration with local communities. The vast majority of the public (around 90%) considers damage to the natural environment and extinction of species to be a serious risk. Around 80% support adopting stricter environmental laws.

Chapter 3. Towards green growth

Include appropriate targets and objectives in the revised National Strategy for Sustainable Development	In 2018, Greece renewed its commitment to sustainable development in a voluntary national review on implementation of the 2030 Agenda (Chapter 3).The 2019 National Strategy for Sustainable and Fair Growth 2030, adopted by the previous government, was expected to guide Sustainable Development Goal implementation until an action plan would be developed. It lists 40 key performance indicators, mostly relating to SDG implementation.
Strengthen overall environmental financial efforts, moving progressively towards full implementation of the polluter-pays and user-pays principles.	Presidential decree PD148/2009 transposed the EU Environmental Liability Directive (ELD, 2004/35/EU) into Greek law and specified criteria for assessing and remediating environmental damage (Chapter 2). Financial security is mandatory for operators with high environmental risk but has so far been implemented only for hazardous waste management activities. A 2017 law provides for cost recovery in water services but there is room to better reflect financial, environmental and resource costs with water charges (Chapter 3). A 2019 law provides for a pricing policy based on regional and local waste management authorities' performance in recovering and diverting waste from landfill (Chapters 1 and 3). There is as yet no information on its outcomes.
Expand the use of economic instruments as part of a green fiscal reform (e.g. energy taxation, progressive car taxation in relation to pollution). Review and revise prices, taxes and subsidies, with the aim of internalising environmental externalities; expand the use of economic instruments to serve environmental objectives	The share of revenue from environmentally related taxes in GDP nearly doubled over the past decade due to increased energy taxation, especially on electricity and transport fuels (Chapter 3). Overall, effective tax rates on CO_2 emissions from energy use are high compared with other OECD countries. However, tax variation across fuels and uses, as well as tax concessions, provide inconsistent carbon price signals. Greece also puts a price on CO_2 emissions via the EU ETS. In 2016, Greece introduced a CO_2 component in the registration tax in addition to the Euro emission criteria. A 2018 tax has significantly reduced consumption of single-use plastic bags.

	A 2019 law provides for a pricing policy based on regional and local waste management authorities' performance in recovering and diverting waste from landfill. Waste collection charges are based on property size. A 2017 law provides for cost recovery in water services but there is room for progress.
Review transport prices and taxes, to better internalise environmental impacts and reflect vehicle environmental performance and fuel efficiency (e.g. linking vehicle taxes to the EU CO_2 vehicle labelling).	Taxes on transport fuels have been increased but the gap between petrol and diesel has widened since the beginning of the crisis, despite diesel's higher carbon and local air pollutant emissions. The tax differential was among the largest in the OECD in 2018. In 2016, Greece introduced a CO_2 component in the registration tax in addition to the Euro emission criteria (Chapter 3). Hybrid cars benefit from a reduction and electric cars are exempt. Since 2010, the annual circulation tax has been based on CO_2 emissions for vehicles registered after October 2010. Electric cars are exempt. Vehicle tax reductions for old vehicles have helped increase the share of used vehicles in registrations since the recovery of the market in 2013. The annual circulation tax on heavy goods vehicles does not consider environmental parameters. The 2019 Law on Tax Reform introduces environmental criteria in the tax treatment of personal use of company cars and provides incentives for public transport use.
Strengthen efforts on energy demand-side management and on market-oriented instruments to achieve more effective and efficient energy use: review the energy price levels and structure, and assess the impact of exemptions and subsidies.	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 National Energy and Climate Plan (NECP) envisages maximum consumption of 16.5 Mtoe in 2030. Energy efficiency measures in the residential and tertiary sectors are expected to have the largest mitigation impact in sectors not covered by the EU ETS by 2030 (Chapter 4). Greece has been promoting energy efficiency in buildings through regulatory measures and financial support notably the Saving at Home programme, mostly financed by EU funds (Chapter 4). The 2018 long-term building renovation strategy aims to improve the energy performance of at least 7% of the current building stock by 2030. The NECP proposes raising this share to between 12% and 15%, which corresponds to 60 000 buildings renovated annually until 2030. Beyond the use of EU funds, Greece envisages developing private funding via energy service companies.
Progressively eliminate environmentally harmful subsidies (e.g. agriculture water tariffs); consider replacing tax exemptions (e.g. on heating oil) with more targeted social compensation schemes.	Although decreasing, support to fossil fuel consumption accounts for more than one-quarter of energy tax revenue, among the highest rates in the OECD. This includes tax expenditure (e.g. excise tax exemption on specific industrial use of coal and coke and on diesel for aircrafts and vessels, plus reduced excises on oil for heating) and budget transfers (subsidies for oil-based power generators in non-interconnected islands, oil heating allowances to households, capacity payments to gas- and coal-based electricity producers). Social tariffs continue to be applied to improve the affordability of electricity and water services. Irrigation benefits from partial water cost recovery and reduced electricity prices. The 2017 law on water pricing is expected to ensure cost recovery and promote sustainable water management. There is little information on potentially environmentally harmful subsidies and tax expenditure.
Review the economic efficiency of environmental subsidies (e.g. to renewable energy sources) and revise them accordingly.	As in other OECD countries, overly generous feed-in tariffs and decreasing costs have supported impressive growth in renewables (Chapter 4). A feed-in premium programme was put in place in 2016. Since 2018, the aid is granted to specific solar photovoltaic and wind installations that have successfully participated in competitive bidding processes.
Continue to invest in efficient and reliable public transport systems, including in cities other than Athens; further develop transport demand management in urban areas.	Out of the EUR 6 billion (EU funds and national contribution) allocated to transport over 2014-20, 48% is to be spent on public transport (Chapter 3). Major sustainable transport projects include extension of the urban public transport systems in Athens and the Attica region and construction of the metro in the Thessaloniki metropolitan area. Despite delays, Greece is moving these projects forward but the lack of sustainable urban mobility plans and weak development of soft transport modes result in continued reliance on cars. The bus fleet was renewed and the Ministry of Infrastructure and Transport plans to procure 750 new buses equipped with anti-pollution technology in Athens and Thessaloniki.
Further develop an active and long-term environmental employment policy.	There is no long-term environmental employment policy and available information on the environmental goods and services sector is not sufficient to support policy making. The 2015 National Waste Management Plan quoted an EU report suggesting that 16 000 jobs could be created in the waste sector but progress is not being tracked. The NECP expects to create nearly 60 000 full-time jobs in the renewables and energy efficiency sectors.

Chapter 4. Climate change	
Continue efforts to *reduce greenhouse gases* with a view to achieving the EU emissions reduction target set for Greece; enhance efforts on energy efficiency and renewable energy sources.	Greece surpassed its Kyoto target for the first commitment period and is on track to meet the 2020 and 2030 targets for emissions not covered by the EU Emissions Trading System (EU ETS). The country is on track to achieve its 2020 target on energy efficiency and reached the 18% share of renewables in gross final energy consumption required by the EU Renewable Energy Directive for 2020. The government elected in 2019 announced a lignite phase-out by 2028 and committed to the objective of climate neutrality by 2050. It adopted an NECP with more stringent targets for 2030 than the EU requirement and a Long-term Strategy to 2050.
Continue *the shift towards cleaner fuels* (*e.g.* natural gas, low sulphur oil) and *renewables* for electricity generation and end-use.	Over the past decade, there has been a shift from oil and coal (lignite) to natural gas and renewable resources. Significant progress has been made in deploying renewables (mainly wind and solar photovoltaics). In 2018, renewables accounted for 13% of total primary energy supply and 31% of electricity generation, above the respective OECD averages of 10% and 26%. Implementation of the 2019 NECP is expected to continue the shift towards cleaner fuels and to phase out coal by 2028.
Chapter 5. Biodiversity	
Adopt and implement the National Biodiversity Strategy and Action Plan, as a comprehensive action-oriented framework for ecosystem and species conservation at both national and local levels; set time-bound objectives and periodically evaluate progress.	A National Biodiversity Strategy with a five-year action plan (NBSAP) was adopted in 2014. It sets time-bound objectives till 2029 and outlines the monitoring system to evaluate the implementation process.
Continue to extend protected areas, particularly including coastal areas and marine ecosystems; complete the implementation of the Natura 2000 network; ensure that all protected areas are provided with management plans and adequate conservation measures.	In 2017 Greece expanded the Natura 2000 network, with a focus on marine areas. It has added 32 areas and extended the boundaries of 63 existing ones. There are 446 Natura 2000 sites. The 2018 law on establishing management bodies for all protected areas provided every Natura 2000 site with such a body. A major ongoing project will update and draft presidential decrees and management plans covering all Natura 2000 areas by the end of 2022.
Further improve the human and financial capacity for nature conservation and the management of protected areas; review the future evolution of the funding system of biodiversity management, with substitutes to EU contributions (e.g. increased use of economic instruments; contribution of national and local public and private funding).	In 2018, Greece promulgated a law establishing management bodies for all protected areas. Capacity building and awareness raising are being further promoted through the LIFE Integrated Project LIFE-IP 4 NATURA, which should boost overall national efforts. All management bodies for Natura 2000 sites are funded by the 2014-20 Operational Programme Transport, Infrastructure, Environment and Sustainable Development and, to a lesser extent, by regional operational programmes. Greece should take the opportunity of the upcoming programming period to streamline and improve management of EU funds.
Increase and disseminate knowledge on the conservation status of species; carry out systematic monitoring of endangered and threatened species, and evaluate the effectiveness of protection projects.	The NBSAP includes targets for monitoring and evaluating its implementation, which should facilitate access to scientific knowledge regarding Greek flora and fauna and fill data gaps. A progress report on meeting targets is expected after the end of the action plan (2019). The LIFE-IP4 Natura project, which started in 2018, will map and assess ecosystems and their services in Natura 2000 sites.
Improve the integration of biodiversity concerns into the agricultural sector, through a targeted use of agri-environmental schemes and specific educational programmes.	The NBSAP actions related to mainstreaming biodiversity into agriculture are not very specific: they refer to improving the sustainable management of agricultural ecosystems. Over 2014-20, EUR 2.8 billion, almost half the RDP budget, is allocated to restoring, preserving and enhancing ecosystems related to agriculture and forestry. The RDP supports farmers to put 17.4% of farmland under contract to preserve biodiversity (relating to agri-environmental programmes, Natura 2000, afforestation and other biodiversity protection payments). The Hellenic Agriculture Organisation "Demeter" provides for education programmes to farmers which include environmental and biodiversity issues.
Increase the rate of *reforestation of burned and degraded forestlands*.	Forest Services are responsible for preventing fires and restoring burned areas either naturally or through artificial reforestation. Natural regeneration is expected in many areas with Mediterranean pine forests. Reforestation projects are carried out through public and private projects. Examples include a LIFE programme on Mount Parnonas in the Peloponnese and an NGO-led project to restore black pine forests, also in the Peloponnese.

Source: Country submission and findings of 2020 EPR.

Part I Progress towards sustainable development

1 Environmental performance: trends and recent developments

During Greece's long recession, emissions of greenhouse gases and most other air pollutants declined faster than GDP. As the economy recovers, it is a challenge to improve well-being, income and employment while reducing poverty and keeping environmental pressures low. Agriculture, transport, tourism and fisheries are putting pressures on biodiversity. This chapter provides a snapshot of key environmental trends in Greece over the past decade. It presents the main economic and social developments and reviews progress in reducing the energy and carbon intensity of the economy, in making the transition to a resource-efficient economy and in managing the natural asset base. It also summarises key policy developments in areas including energy and climate, air, water and waste.

1.1. Introduction

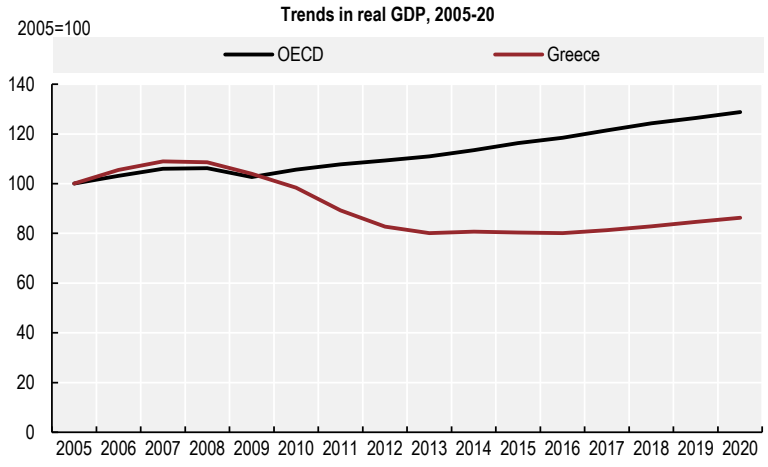
After a long, deep recession, the Greek economy started to recover in 2017. Following extensive fiscal and structural reforms, the country faces difficult challenges in improving well-being, income and employment and reducing poverty. Between 2009 and 2017, some environmental pressures, including emissions of greenhouse gases (GHGs), and sulphur and nitrogen oxides (SO_X and NO_X), declined faster than gross domestic product (GDP). Since 2013, however, energy consumption, municipal waste generation and pesticide use have grown more quickly than economic activity.

Greece has made significant progress in shifting the energy mix from oil and coal to natural gas and renewables. However, it ranks among the ten most carbon-intensive economies in the OECD due to its strong reliance on fossil fuels. Agriculture, transport, tourism and fisheries are putting pressures on the country's considerable biological wealth.

1.1.1. Economic performance and structure of the economy

After a deep recession over 2008-16, during which real GDP fell by 26%, the economy has started to recover (Figure 1.1) (OECD, 2018a). GDP growth strengthened at 1.4% in 2017 and 1.9% in 2018 and is projected to remain around 2% until 2021 (OECD, 2019a). Employment and real wage gains will support consumption, while improving financing conditions and confidence will boost business investment. Growth is being supported by rising goods exports and tourism despite sluggish external demand. The pace of reforms has accelerated and broadened in recent years, with major fiscal adjustments reversing imbalances in public finances and the current account. In 2017, Greece returned to the international debt market after a three-year hiatus, signalling investors' increasing confidence in its prospects and improved fiscal credibility.

Figure 1.1. After a severe recession, the economy is recovering



Source: OECD (2019), *OECD Economic Outlook: Statistics and Projections* (database).

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Despite this progress, after three bailout plans[1] by the European Commission, the European Central Bank and the International Monetary Fund, the public debt, at more than 180% of GDP, is still among the world's highest (OECD, 2018a). Slow progress in attracting new foreign direct investment is also a concern, as is the scale of banks' non-performing loans. Poverty rose sharply during the crisis, especially among families

with children, the young and the unemployed. Although labour market reforms have boosted employment, 19.3% of the active population was unemployed in 2018, the highest rate in the OECD.

Greece has a small, service-based economy. In 2017, services (mostly trade, transport, accommodation and food, and real estate activities) contributed 79% of total value added, well above the OECD average of 73%. Tourism is a vital driver of the Greek economy. In 2018, it directly accounted for 12% of GDP, while its direct and indirect contribution was estimated at between 26% and 31% of GDP (INSETE, 2019). Agriculture is also more important than in most other OECD countries, accounting for 4% of value added and 12% of employment. The share of industry[2] in value added rose from 11% to 15% over 2010-17, driven by increasing contributions from food product manufacturing and basic metals. Meanwhile, construction's share fell by half, to 2%. The economy is becoming more open, although exports, at 36% of GDP in 2018, remained below the EU average of 46%. Goods, especially oil products,[3] account for an increasing share of total exports. Within service exports, the share of tourism (52% in 2017) has exceeded that of transport (32%, mainly shipping) since the mid-2010s.

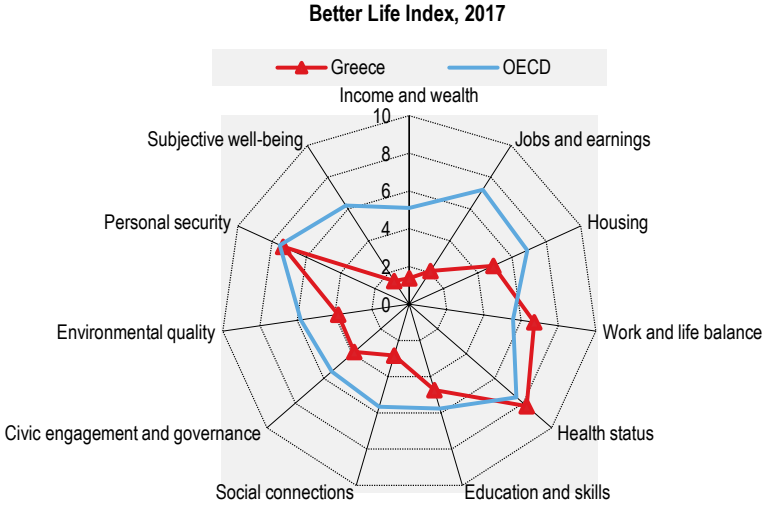
1.1.2. Population, well-being and environmental quality of life

After a decade of steady growth, population has been decreasing since 2010 due to a reduced fertility rate and, until 2015, negative net migration (Eurostat, 2018). Greece is the main entry point to Europe for refugees and migrants travelling on the eastern Mediterranean route (OECD, 2019b). Illegal border crossings soared from an annual average of 45 000 over 2008-14 to 885 000 in 2015, subsequently dropping to 42 000 in 2017. The old-age dependency ratio[4] is expected to continue to rise from an already high rate of 33% in 2016 to 71% in 2050, though the public ageing cost is expected to decline as a result of pension reforms (EC, 2018a).

Although a majority of people live in cities of more than 50 000, the share of population in rural regions is higher than the OECD average (Basic statistics). The Athens and Thessaloniki metropolitan areas account for 43% of the population and 56% of GDP (OECD, 2018b). While the crisis affected all regions, disparity among them has significantly widened in the past decade.

Greece ranks below the OECD average in most dimensions of the OECD's Better Life Index (Figure 1.2). It compares favourably only in health status and work-life balance. The legacy of the crisis weighs especially on subjective well-being, income and jobs.

Figure 1.2. The crisis has weighed on well-being indicators



Note: Each well-being dimension is measured by one to four indicators from the OECD Better Life Index set. Normalised indicators are averaged with equal weights. Indicators are normalised to range between 10 (best) and 0 (worst) according to the following formula: (indicator value - minimum value) / (maximum value - minimum value) x 10.
Source: OECD (2017), *OECD Better Life Index*, www.oecdbetterlifeindex.org.

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1.2. Transition to an energy-efficient and low-carbon economy

1.2.1. Energy supply and demand

Key policy developments

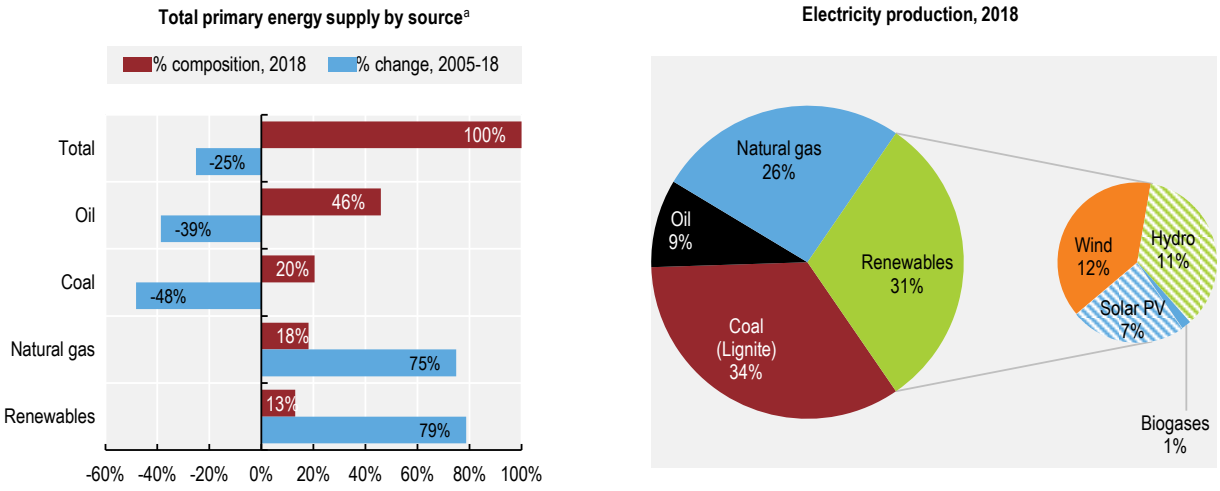
In a welcome move, the government that was elected in 2019 announced a lignite phase-out by 2028. As required by EU rules, Greece released a National Energy and Climate Plan (NECP) and a Long-term Strategy to 2050 in 2019, in line with the Paris Agreement (MoEE, 2019; MoEE, 2020) (Chapter 4). The NECP outlines an evolution scenario for the energy system and proposes policies and measures for achieving the national energy and climate targets for 2030 and enabling the transition to a climate-neutral economy by 2050. By 2030, the plan aims to i) reduce total GHG emissions, excluding those from land use, land use change and forestry (LULUCF), by 56% from 2005 levels (42% from 1990 levels); ii) reduce GHG emissions not covered by the EU Emissions Trading System (EU ETS) by 36% from 2005 levels, more than twice the reduction required for Greece by EU legislation (16%);[5] iii) raise the share of renewables in gross final energy consumption to at least 35%; and iii) limit final energy consumption to 16.5 million tonnes of oil equivalent (Mtoe). Other objectives include increasing energy security, strengthening the competitiveness of the economy, protecting vulnerable consumers and making the domestic energy market more competitive. The NECP also integrates the 2020-30 targets set in the new National Emission Ceilings (NEC) Directive (Section 1.2.3).

The NECP expects promotion of renewables in electricity generation and improvement of the conventional power system (decommissioning of all lignite power plants, expansion of the gas-fired power plant fleet, interconnection of certain islands with the mainland grid) to contribute the most to GHG emission reduction (Chapter 4). On the other hand, it predicts low emission reductions in the transport sector, suggesting a need to better integrate climate targets in transport policy.

Energy supply and electricity generation

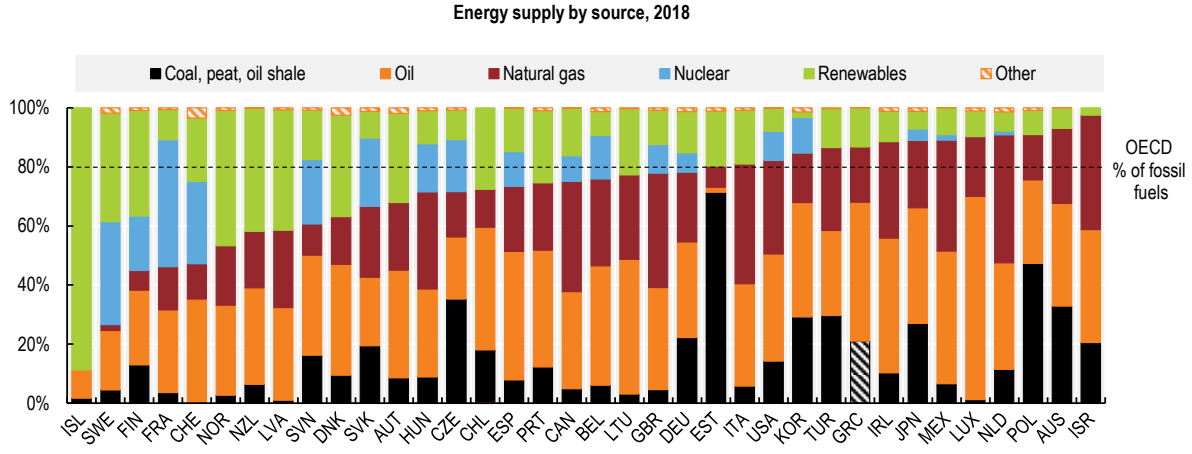
Total primary energy supply (TPES) dropped significantly during the economic crisis and has remained stable since 2013. Oil is the dominant fuel, accounting for half of TPES, while domestic coal is the major electricity generation source (Figure 1.3). Greece does not use nuclear energy and is not considering this option. Over the past decade there has been a clear shift from oil and coal to natural gas and renewables. However, Greece remains among the top ten OECD countries with the highest shares of fossil fuel in the energy mix (Figure 1.4). In 2018, energy intensity (expressed as TPES per unit of GDP) was below the OECD average but on a par with the EU average. It has decreased more slowly than in most other OECD countries (Figure 1.5).

Figure 1.3. A shift from oil and coal to natural gas and renewables has occurred



a) The breakdown does not show electricity trade and a negligible quantity of non-renewable waste.
Source: IEA (2019), *IEA World Energy Statistics and Balances* (database).

Figure 1.4. The share of fossil fuel in the energy mix is high



Note: Breakdown excludes electricity trade.
Source: IEA (2019), *IEA World Energy Statistics and Balances* (database).

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Renewable energy sources

The 2010 National Renewable Energy Action Plan (NREAP) aims to reach a 20% share of renewables in gross final energy consumption by 2020, above the objective of 18% imposed by the relevant EU directive (2009/28/EC). The NREAP sets targets by sector: 40% in gross final electricity consumption, 20% in heating and cooling and 10% in transport final consumption. The NECP envisages raising these shares to more than 60% for electricity, over 40% for heating and cooling and 19% for transport by 2030 (MoEE, 2019).

With a share of 18% in 2018, Greece achieved the 2020 target of the Renewable Energy Directive. While the country has already exceeded the 2020 target on heating and cooling, the NECP projects that it will not meet the 2020 NREAP objectives on electricity and transport.

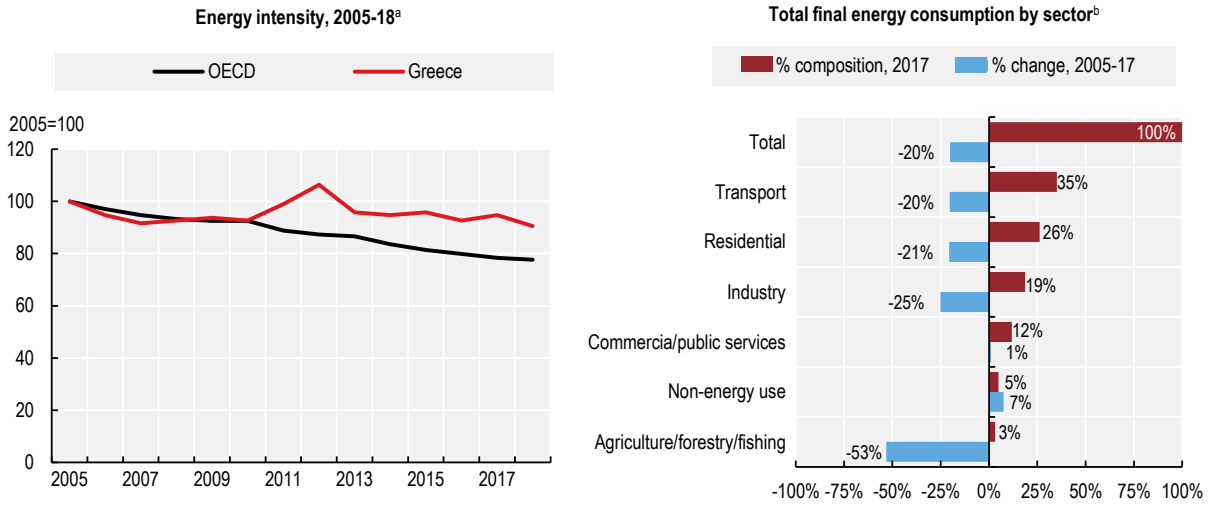
Since 2005, renewables (mainly wind and solar photovoltaics) have increased by 79% in the energy supply and by 153% in electricity production, thanks to generous feed-in tariffs and decreasing technology costs (Chapter 4). In 2018, the shares of renewables in TPES (13%) and electricity generation (31%) were above the OECD averages of 10% and 26%. Greece was one of the OECD countries with the highest shares of solar PV in electricity generation. Integrating additional variable renewables while ensuring system reliability will require strengthening the internal transmission network, including interconnecting many islands with the main network, investing in flexible generation, enhancing regional interconnections, exploring the potential of energy storage and implementing demand-response programmes (IEA, 2017).

Energy consumption

The third National Energy Efficiency Action Plan (2014) aims at achieving final energy consumption of 18.4 Mtoe in 2020 (a 12% reduction from 2005), in line with the Energy Efficiency Directive (2012/27/EU).

Transport accounts for the highest share of final energy consumption, followed by the residential sector and industry (Figure 1.5). Between 2005 and 2017, energy consumption decreased by 20%, driven by the decline in economic activity and, to a lesser extent, by progress in energy efficiency (EC, 2017a). Despite an increase in consumption since 2013, Greece is on track to reach its 2020 target (Chapter 4).

Figure 1.5. Energy intensity decreased more slowly than in the OECD



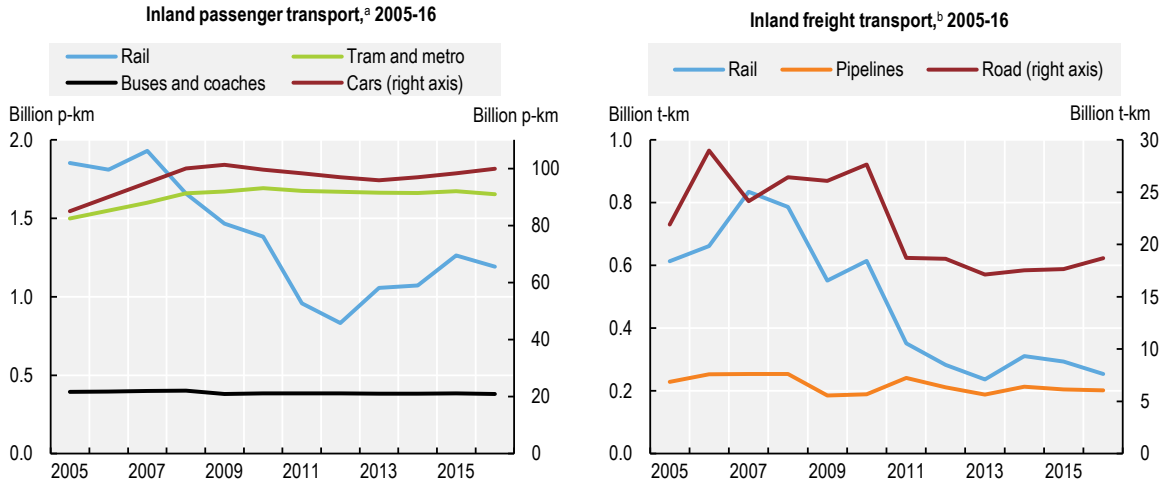
a) Total primary energy supply per unit of GDP at 2010 prices and purchasing power parities.
Greece: the peak in 2011-12 is due to cold winters and anticipated higher taxation of heating oil.
b) Agriculture: includes other non-specified energy use.
Source: IEA (2019), *IEA World Energy Statistics and Balances* (database).

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Transport

Transport is the second highest GHG emitter. Road transport accounts for a larger share of energy consumed (30%) than the OECD Europe average (26%), reflecting its predominant share (Figure 1.6). Inland transport activity, freight in particular, fell significantly over 2009-13 but has since started to grow again (EC, 2018b). Rail transport recorded the sharpest drop, although passenger rail transport bounced back in 2013. By 2016, car passenger transport had nearly recovered to its pre-crisis level.

Figure 1.6. Road transport is predominant



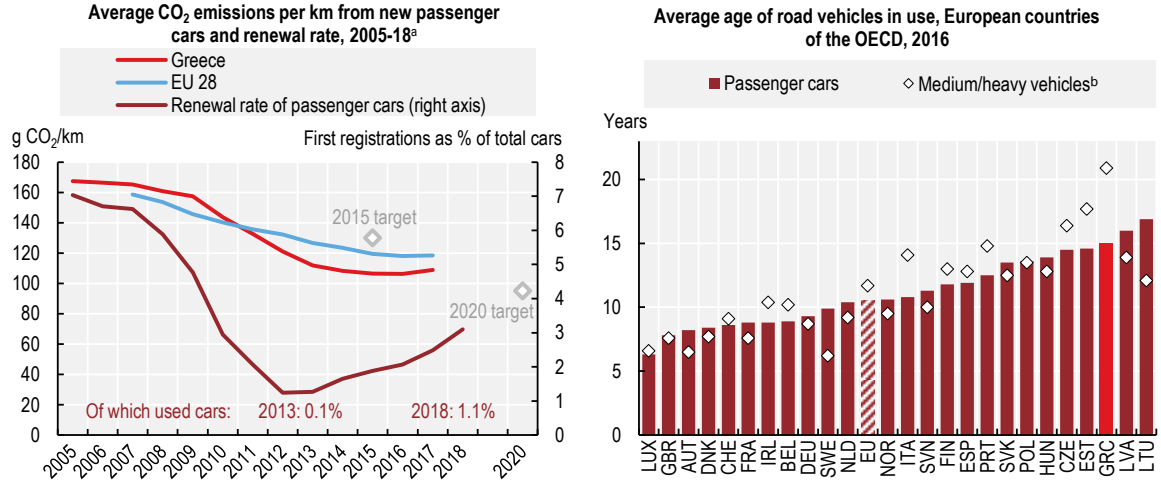
a) Expressed in passenger-kilometer.
b) Expressed in tonne-kilometer.
Source: EC (2019), *EU Transport in Figures 2018*.

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Although Greece's car ownership rate is slightly below the EU average, its motorisation rate is higher than in a majority of OECD countries. This is because Greece has many low-efficiency trucks[6] mostly operated on own account (National Bank of Greece, 2017). The number of passenger cars in use slowed due to the recession, lower demand for new cars and incentives for scrapping old vehicles, but began growing again in 2016. The decline in the passenger car renewal rate and growing share of used cars among vehicles put into circulation contributed to the ageing of the car fleet, one of the oldest in Europe (Figure 1.7).

Unlike in the majority of OECD countries, diesel accounts for less than half of road fuel consumption. Greece has relatively few alternative fuel vehicles (mostly running on liquefied petroleum gas), so petrol cars remain largely dominant. However, vehicle and fuel taxation, combined with removal of a ban on diesel cars in Athens and Thessaloniki, has supported sales of diesel passenger cars (Chapter 3). Average carbon dioxide (CO_2) emissions of new cars fell to 108.8 g/km in 2017, one of the lowest levels in the EU, although it is widely recognised that actual emissions are higher (Figure 1.7).

Figure 1.7. CO_2 emissions from new cars have fallen significantly but the vehicle fleet is old



a) Targets set in Regulation EC No 443/2009 of the European Parliament and of the Council setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles.
b) Includes buses. Data for Austria, Germany and Sweden include only buses.
Source: ACEA (2018), *ACEA Report: Vehicles in Use – Europe 2018*; ELSTAT (2019), *Road Transport Statistics* (database); Eurostat (2019), *Average CO_2 Emissions per km from New Passenger Cars* (database).

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Ensuring environmental sustainability is one of five high-level objectives[7] of the 2019 National Transport Plan (NTP), which identifies infrastructural, operational and institutional measures to be implemented to 2037 (MIT, 2019). The plan proposes actions to improve road freight transport efficiency and spur integration with rail, renew the vehicle fleet and develop electric charging infrastructure, improve intermodality between intercity public transport and urban transport, develop sustainable urban mobility plans and promote soft transport modes. However, the NTP notes that measures such as a scrappage programme for heavy-duty vehicles, fiscal incentives for greening the vehicle fleet and electro-mobility development are challenging and require further discussions.

Planned infrastructure is expected to more than double passenger rail transport and increase rail freight transport by 75% between 2017 and 2037, though from a very low level. At the same time, road transport is projected to grow significantly, resulting in few changes in the modal split. While the NTP sets targets for increasing the transit freight traffic volume (e.g. a sevenfold increase in transit cargo volume in Thessaloniki), there is no target on modal split or on GHGs and other air pollutant emissions. Still, the NTP expects a 17% reduction in environmental external costs of transport, compared to the baseline scenario, by 2037.

1.2.2. Climate change mitigation and adaptation

Emission profile and progress towards targets

Total GHG emissions peaked in 2005 and have since declined by 30% (Chapter 4). In 2017, the main sources of emissions were the energy industry, which accounted for 42% of total emissions, and transport at 18%. The decline in economic activity and related energy demand during the recession and the increase in renewables use have led to emission reductions (IEA, 2017). However, Greece ranks among the ten most carbon-intensive economies in the OECD due to its high reliance on coal and diesel for electricity generation (especially on the non-interconnected islands).

Greece surpassed its Kyoto target for the first commitment period of limiting the increase of GHG emissions (excluding LULUCF) to 25%, achieving a 17% rise over 2008-12 from 1990 levels (Chapter 4) Emissions

not covered by the EU ETS decreased by 28% between 2005 and 2018, putting Greece on track to meet its targets of reducing related emissions by 4% by 2020 and by 16% by 2030. In 2017, EU ETS installations represented slightly more than half the country's GHG emissions. EU ETS-covered emissions decreased by 36% between 2005 and 2018.

The NECP raises Greece's climate ambition for 2030: GHG emissions are expected to decline by 56% below 2005 levels (or 42% below 1990 levels) compared with 41% below 2005 levels under most recent projections with existing measures. However, ambitious additional measures will need to be implemented to progress towards net zero emissions by mid-century, as outlined in the Long-term Strategy to 2050.

Climate change outlook and adaptation policy

It is expected that by the end of the 21st century, precipitation levels will have fallen by between 5% and 19% countrywide, depending on the scenario, while air temperature will have increased by between 3.0ºC and 4.5ºC (Bank of Greece, 2011). Around 1 000 km of the country's 18 400 km of coastline is highly vulnerable to climate change, with average sea level expected to rise by between 0.2 m and 2 m, compounded by extreme wave events and local factors (tectonics, geomorphology, etc.). About 58% of the total Aegean coastline is highly vulnerable to the projected impact (MoEE, 2018a). Water scarcity is of particular concern. Agriculture is the sector expected to be most severely affected by climate change, while the impact on tourism and coastal systems is likely to have major consequences on household income and the economy as a whole (MoEE, 2016[18]).

Under an inaction scenario, it is estimated that GDP would drop by an annual 2% by 2050 and 6% by 2100, and the total cumulative cost for the economy over the period to 2100, expressed as GDP loss relative to base year GDP, would amount to EUR 701 billion (at 2008 prices). A drastic reduction in Greece's GHG emissions as part of a global effort to contain the average global temperature rise to no more than 2º C would reduce the cost by 40% while an adaptation scenario would cut it by 20%.

The 2016 National Adaptation Strategy defines the goals, principles and priorities of adaptation and lists potential adaptation measures for sectors that are likely to be significantly affected by climate change: biodiversity and ecosystems, agriculture and food security, forestry, fisheries, aquaculture, water resources, coastal areas, tourism, energy, human health, the built environment, transport, cultural heritage, industry, mining and insurance. The strategy is being translated into regional adaptation action plans that will set priorities based on regional vulnerability (Chapter 4).

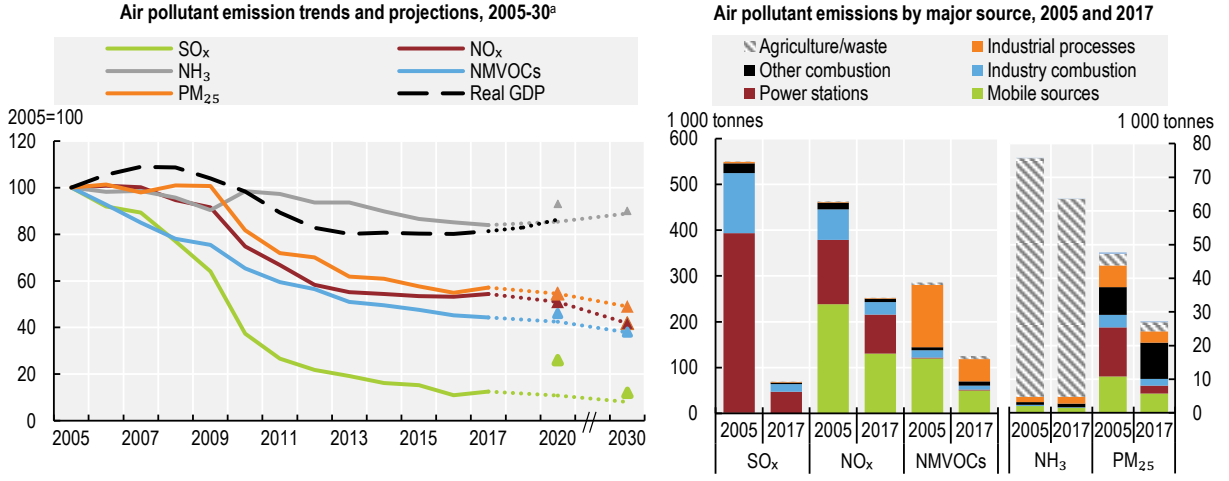
1.2.3. Atmospheric emissions and air quality

Greece's air management policy is shaped by the 2013 Clean Air Programme for Europe. The country fell behind in developing its national air pollution control programme[8] to ensure that it met the reduction commitments for 2020 and 2030 set in the NEC Directive. Greece established a transitional national plan giving some power plants more time to comply with the Industrial Emissions Directive (2010/75/EU).

Air emissions

Since 2009, emissions of major air pollutants have decreased faster than economic activity except in the case of ammonia (NH_3) (Figure 1.8). The reduction in energy consumption, abatement measures such as flue gas desulphurisation, changes in the electricity mix (increased use of gas and renewables, decommissioning of old coal power plants), reduction of fuels' sulphur content and the scrapping of old vehicles have been the main drivers of this decline. However, levels of emission intensity per unit of GDP remain high, mainly due to oil-based transport. Passenger cars are the main mobile source of emissions of non-methane volatile organic compounds (NMVOCs), while heavy duty vehicles and ships dominate NO_X and $PM_{2.5}$ emissions from transport (Box 1.1).

Figure 1.8. Most air emissions decreased faster than economic activity



a) Emission trends, projections with existing measures (dotted lines) and reduction targets (markers) under the National Emission Ceilings Directive (2016/2284/EC).
Source: Eionet (2019), *National Emission Ceilings Directive Inventory Submission 2019;* OECD (2019), *OECD Economic Outlook: Statistics and Projections* (database).

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In 2010, air emissions were below the ceilings imposed by the NEC Directive except in the case of NO_X. According to national projections, Greece is on track to meet its 2020 and 2030 emission reduction commitments.

Box 1.1. Reducing air pollution from ships

Maritime shipping is an important contributor to air pollution in Europe, particularly in port cities. While current regulations of the International Maritime Organization and the EU will cut SO_2 emissions from international shipping up to 2030, without further controls they will grow again after 2030 and NO_X emissions will exceed those from land-based sources in the EU.

Designating the Mediterranean Sea as an Emission Control Area (with stricter controls on emissions from ships, as in the Baltic and North seas) could cut emissions of SO_2 from international shipping by 80% and of NO_X by 20% by 2030, compared to the situation with current legislation.

The main emission control measures include reduction of the sulphur content of marine fuels, combustion process optimisation, exhaust gas cleaning and catalytic reduction systems. Connecting ships at berth to onshore power supply (cold ironing) can also help reduce NO_X and PM emissions. In 2018, the port of Killini was the first cold ironing pilot in the eastern Mediterranean. An EU-funded project called ELEMED (for ELectrification of the Eastern MEDiterranean), involves two ports in Greece (Killini and Piraeus) and one each in Cyprus (Limassol) and Slovenia (Koper). It paves the way for wider implementation in Greece and elsewhere in the region.

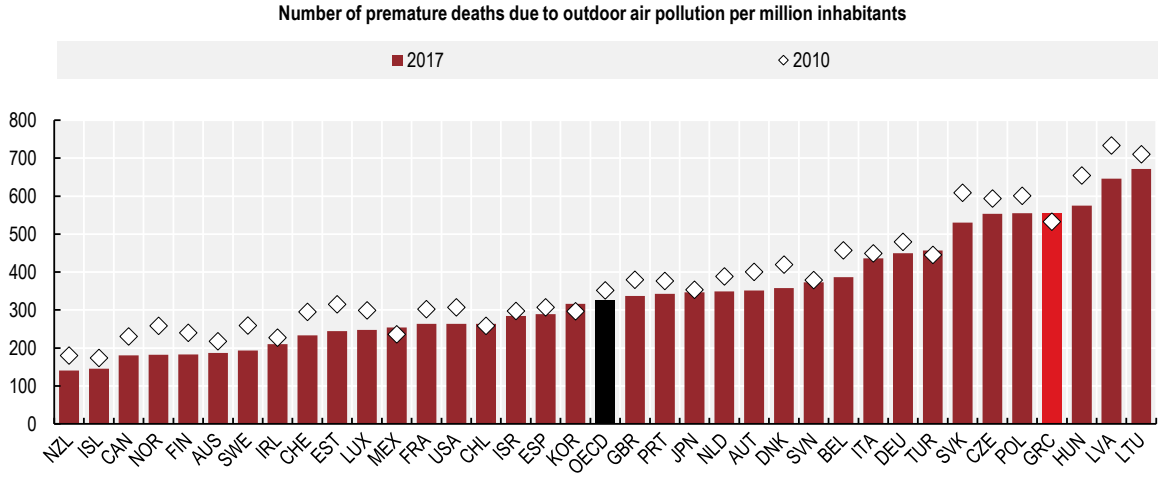
Source: Cofala et al. (2018) ; www.elemedproject.eu.

Air quality

The Greek population is severely affected by air pollution. Athens and Thessaloniki are among the top 20% of most polluted metropolitan areas in OECD countries. Since the beginning of the decade, despite decreasing mean exposure to small particulates, the number of premature deaths attributable to ambient air pollution by $PM_{2.5}$ and ozone have remained broadly constant, aside from weather-related variations (Figure 1.9). Using the value of a statistical life techniques, the welfare cost of the estimated 7 000 premature deaths was estimated at 6.7% of GDP in 2017, nearly twice the OECD average. Natural sources, such as Saharan dust, are a significant factor for particulate pollution, especially in southern

Greece. Improving the air quality monitoring system would help in increasing the accuracy of exposure estimates and designing appropriate measures to reduce the health impact of air pollution (Klein et al., 2019).

Figure 1.9. Greece has one of the highest rates of mortality from air pollution



Source: OECD (2019), "Environmental risks and health", *OECD Environment Statistics* (database).

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In the past decade, concentrations of the main air pollutants have decreased with reduced economic and transport activity, scrapping of old vehicles and increased use of natural gas. However, higher heating oil prices have pushed households to switch from oil to wood for heating, causing severe winter episodes of PM pollution (Athanasopoulou, 2017[20]).

Progress in reducing urban air pollution has stalled since fuel consumption started to grow again in 2013. Concentrations of NO_2, PM_{10}, $PM_{2.5}$ and benzene have stabilised or increased at some monitoring stations (MoEE, 2018b). In 2017, exceedances of EU air quality standards were recorded for NO_2, PM_{10}, benzene and benzo[a]pyrene (EEA, 2019a). The European Commission has opened infringement procedures against Greece for not complying with limit values for PM_{10} and NO_2 and for failure to put in place adequate air quality monitoring in Thessaloniki.

Like other Mediterranean countries, Greece regularly records high levels of ozone concentrations, which are exacerbated in Athens by topography (basin surrounded by mountains) and meteorological conditions (temperature inversions, low wind speed, high temperature). In 2017, the EU target value of ozone concentrations was not met in many Greek locations.

1.3. Transition to a resource-efficient economy

1.3.1. Material productivity and waste

Key policy developments

Low resource productivity and recovery rates, high waste generation and fines paid for not respecting EU waste legislation make the case for a shift to a circular economy. In 2018, the government Economic Policy Council approved a National Circular Economy Strategy and two-year action plan, later extended to 2023. The long-term (2030) goals include moving up the waste hierarchy; promoting industrial symbiosis and business clusters; supporting consumption patterns of reusing and repairing rather than buying new

products; enhancing partnerships across industry, academia and civil society; raising awareness; and monitoring progress through indicators. Short-term actions focus on making regulatory and legislative reforms (e.g. developing end-of-life criteria for specific waste streams, recycled materials and by-products; enabling food donations; promoting green public procurement; setting standards for reuse of construction waste and treated wastewater), mapping financing options (EU funds and tax incentives), enhancing knowledge and establishing a governance body to oversee implementation. The country also established a multi-stakeholder forum to promote circular economy business models and innovations.

The 2015 National Waste Management Plan (NWMP) and accompanying Waste Prevention Plan, along with 13 Regional Waste Management Plans and the 2016 National Hazardous Waste Management Plan, complement the framework to promote a circular economy. In addition, the 2017 Law on Recycling aligned existing legislation with circular economy principles.

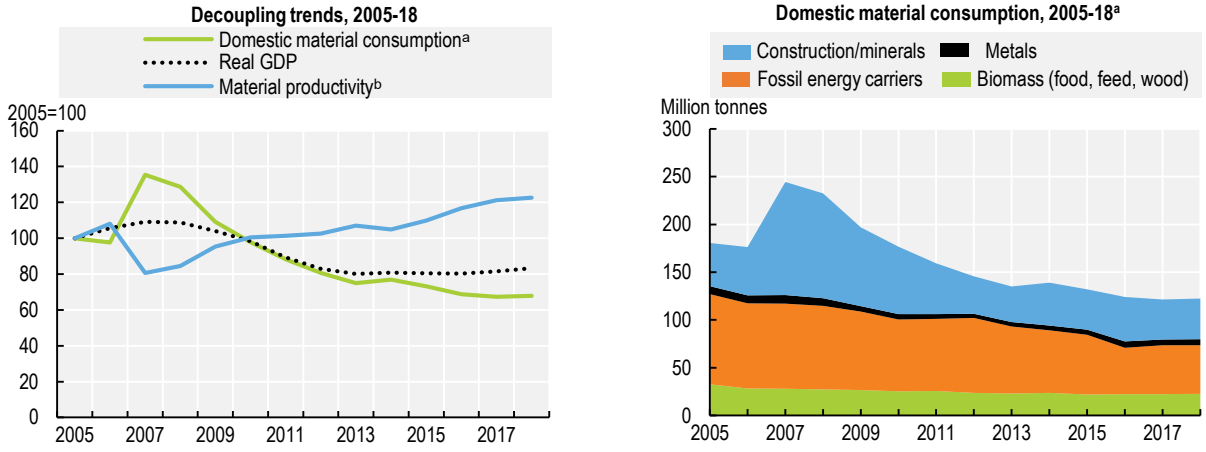
The NWMP has set aims for 2020 of significantly reducing per capita waste generation, reaching 50% of municipal waste being prepared for reuse/recycling, using energy recovery as a supplementary treatment option when other recovery options are exhausted and limiting landfilling to less than 30% of municipal waste generated.

Material productivity

During the crisis, domestic material consumption (DMC)[9] decreased faster than GDP as construction and coal extraction declined (Figure 1.10).

Material productivity improved as a result, though not enough to reach the OECD average. Per capita DMC, especially consumption of biomass and non-metallic minerals, is below the OECD Europe average, while consumption of fossil energy material remains high.

Figure 1.10. Material consumption dropped as construction and coal extraction declined



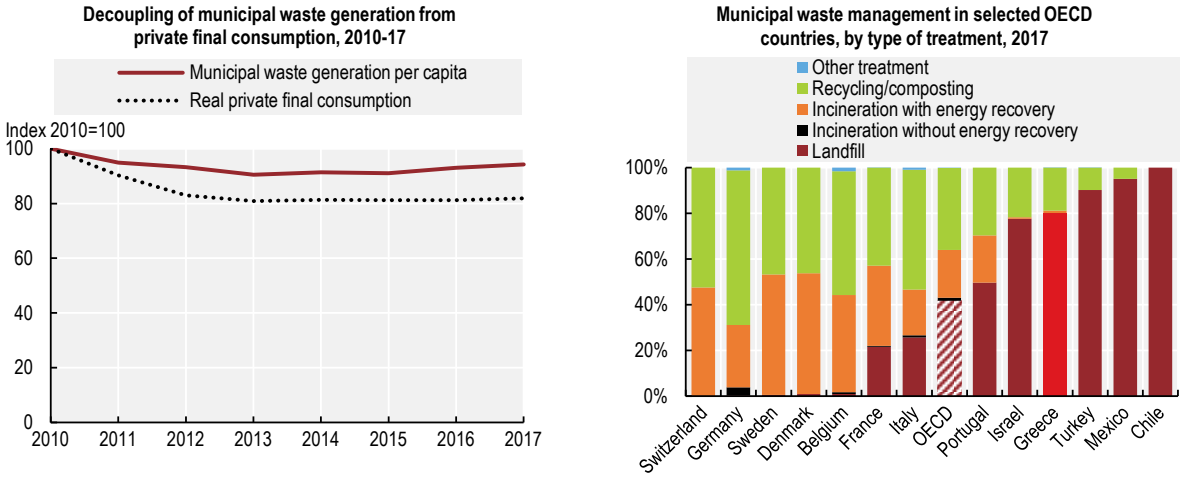
a) Refers to domestic material consumption, i.e. domestic material extraction plus imports minus exports of materials and derived products.
b) Material productivity designates the amount of GDP generated per unit of materials used (GDP/DMC). A rise in material productivity is equivalent to a decline in material intensity (DMC/GDP).
Source: OECD (2019), "Material resources", *OECD Environment Statistics* (database).

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Waste management

The latest State of the Environment report identifies waste management as the most challenging environmental area (NCESD, 2018). It is the main environmental field for EU infringement cases against Greece (Chapter 2). In 2017, municipal waste generation amounted to 512 kg per capita, above the OECD Europe average and relatively high given Greece's low income levels, probably because of tourism. Since 2013, municipal waste generation has increased faster than private consumption. In 2017, 80% of the amount generated was sent to landfill, nearly twice the OECD average (Figure 1.11).

Figure 1.11. Municipal waste generation has increased since 2013 and the landfilling rate is high



Note: Data refer to household and similar waste collected by or for municipalities, originating mainly from households and small businesses. Includes bulky waste and separate collection.
Source: OECD (2019), "Municipal waste generation and treatment", *OECD Environment Statistics* (database).

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Greece is at risk of missing the 2020 target of 50% preparation for reuse/recycling of municipal waste set out in the Waste Framework Directive[10] (EC, 2018c). It missed the Landfill Directive targets[11] for reducing municipal biodegradable waste disposal and is unlikely to reach the NWMP target of recycling 40% of biowaste by 2020. Poor performance is due to lack of infrastructure for source separation of recyclables, notably biowaste, along with low public awareness, lack of financial incentives and the absence of relevant economic instruments.

Greece has made progress in expanding extended producer responsibility systems, which cover packaging waste; waste oils, tyres, batteries and accumulators; waste electrical and electronic equipment (WEEE), end-of-life vehicles; and construction and demolition waste. Despite decreasing collection rates and rising informal recycling during the recession, these systems have generally met their recycling and recovery targets, with the exception of packaging glass and some types of WEEE (HRA, 2019; Scheinberg, 2016). However, achieving more ambitious goals will be challenging. Such systems could be made more effective by improving monitoring and enforcement, clarifying roles between producer responsibility organisations and municipalities, supporting the latter's efforts to fulfil their obligations, raising awareness and integrating informal recycling into the formal system.

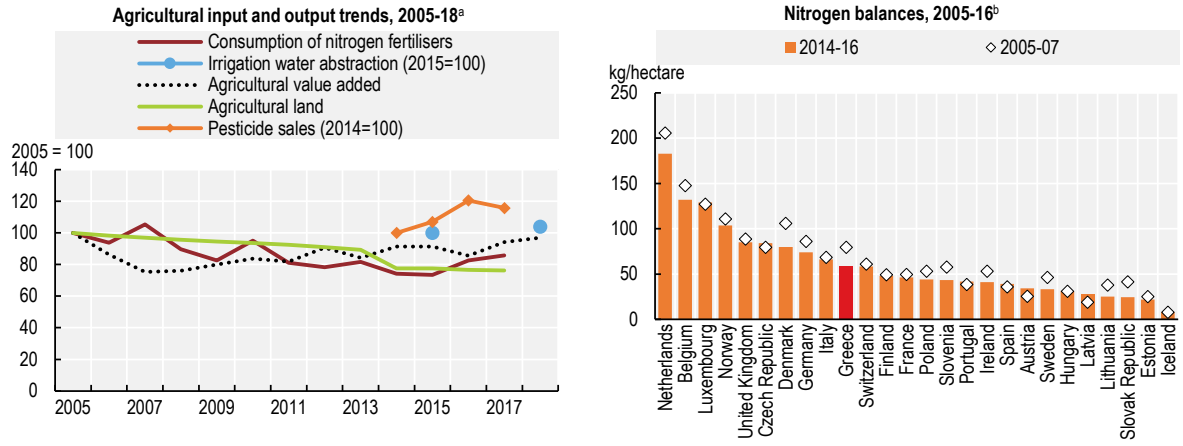
Cheap landfilling and illegal disposal have discouraged recycling (EC, 2019). A 2012 landfill tax law was not implemented. It was replaced by a 2019 law providing for a landfill tax as part of a pricing policy based on regional and local waste management authorities' performance in recovering and diverting waste from landfill. As this law applies from 2020, there is as yet no information on its outcomes. Waste collection charges are generally based on property size. There is thus room to develop "pay as you throw" systems as part of instruments to encourage people to reduce and sort waste. In a welcome step, Greece introduced a tax on single-use plastic bags in 2018 (EUR 0.4, rising to EUR 0.9 in 2019), which reduced their use by 85% in one year.

Greece has made important strides in closing illegal landfills. However, the remaining ones[12] will be difficult to close unless new facilities are built. There are also gaps in implementing legal obligations regarding hazardous waste management. The reasons include data quality issues on generation and treatment, lack of infrastructure, the need to deal with historical waste and weak enforcement (BiPRO, 2017). Between 2014 and 2019, Greece paid EUR 85 million in fines for non-compliance with EU waste legislation.

1.3.2. Agricultural inputs

Over the past decade, nutrient surpluses have declined (Figure 1.12). However, fertiliser and pesticide use and agricultural water abstraction have increased in recent years while agricultural area has been reduced.

Figure 1.12. Agricultural use of fertilisers, pesticides and water has increased in recent years



a) Based on data expressed in tonnes for apparent consumption of fertilisers and for pesticide sales and in EUR at constant prices for agricultural value added.
b) Data are period averages (not all countries have data for 2016).
Source: AUA (2019), *Assessment of RDP Contribution to Water Management and Water Use Efficiency*; FAO (2019), *FAOSTAT* (database); OECD (2019), "Environmental performance of agriculture", *OECD Agriculture Statistics* (database); OECD (2019), *OECD National Accounts Statistics* (database).

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In 2013, Greece adopted a National Action Plan on Sustainable Use of Pesticides with measurable risk reduction targets (EC, 2017b). Most professional users have since been certified. The 2015 target of a 10% reduction in non-compliance with maximum pesticide residue limits was not achieved, partly due to more active substances being detected. The target of reducing acute poisoning incidents by 5% was achieved, but that of increasing the use of low-drift nozzles by 5% could not be monitored, as only 19% of pesticide application equipment had been inspected by early 2018[13] (Bourodimos et al., 2018). More than half of professional users dispose of empty pesticide packages in common waste bins, a further 12% do so without rinsing them, 19% burn or bury containers and less than 10% participate in collection/recycling programmes (MRDF, 2016).

Organic farming increased from 7% of the agricultural area in 2005 to 9% in 2018, above the 2017 OECD average of 7% (Chapter 5). Despite significant EU support, the share has grown less rapidly than in most countries.

1.4. Managing the natural asset base

1.4.1. Physical context and land use

Greece is located in southeastern Europe and shares borders with Albania, North Macedonia, Bulgaria and Turkey. Its topographic diversity, including mountains, a lengthy coastline and thousands of islands, contributes to its considerable biological wealth (Chapter 5). Agricultural land accounts for half the land area and is almost evenly divided between arable land and permanent crops, and permanent pasture (Basic statistics). Forests cover 32% and inland waters, including wetlands, represent 2%. The remainder is built-up areas and other land.

Although Greece's artificial land coverage is below the EU average, the country has registered a shift from pasture and agricultural land to urban areas since 1990, resulting in habitat loss, degradation and fragmentation (Chapter 5). Construction of tourist facilities and secondary residences, in some cases without proper planning or building permits in coastal areas, has been a strong driver of continued urbanisation (Government of Greece, 2018). The motorway network has doubled over the past decade, exacerbating landscape fragmentation.

1.4.2. Biodiversity and ecosystems

Greece is of great importance to European and Mediterranean biodiversity, being home to abundant flora and fauna, including many endemic plant and animal species, and a wide variety of ecosystems (Chapter 5).

Habitat conservation status under the EU Habitats Directive has improved. Nearly two-thirds of habitats have favourable status. However, most coastal habitats are rated as unfavourable/inadequate and more than half of species as unfavourable. One in three freshwater fish species and one in four mammal and amphibian species are at risk of extinction.

The main causes of biodiversity loss in Greece are natural system modifications, including urbanisation and habitat fragmentation, pollution, invasive alien species, climate change and fires. Key pressures come from agriculture, fisheries, transport and tourism (especially coastal).

Progress has been made in expanding protected areas, which cover 32% of the terrestrial area and 20%[14] of the territorial sea. Greece has thus largely achieved the 2020 Aichi target 11. Few protected areas have management plans.

1.4.3. Water resource management

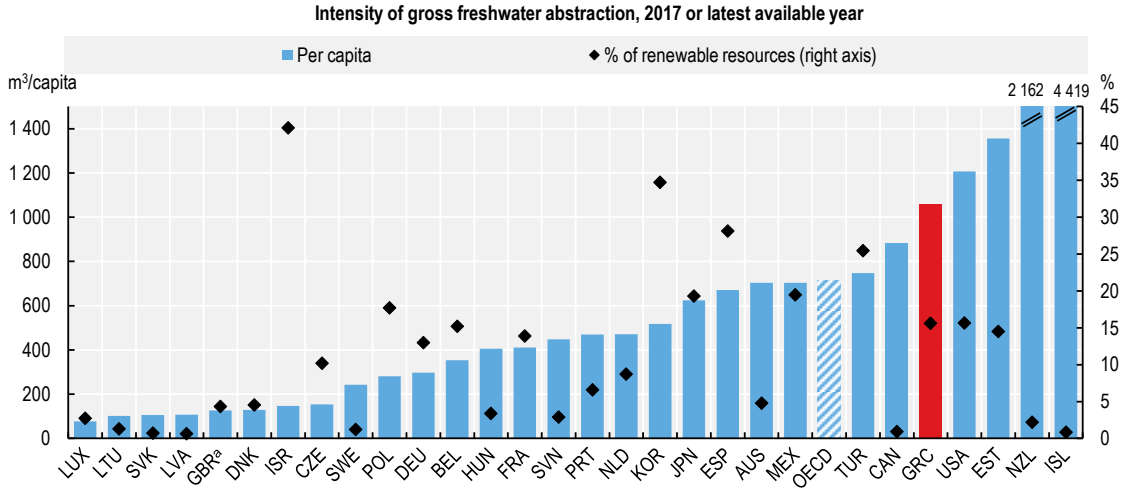
As in other environmental areas, water policy is shaped by EU obligations. In 2017, Greece adopted its second round of River Basin Management Plans (RBMPs) under the Water Framework Directive (WFD) after a two-year delay (EC, 2019). In 2019, it adopted an action plan to protect waters against pollution caused by nitrates from agricultural sources for the 30 defined vulnerable areas.

Water resources

As Greece is more generously endowed with freshwater resources than other Mediterranean countries, freshwater resources are under only moderate stress at the national level despite high abstraction levels. However, spatial and seasonal distribution of water resources and use varies widely. Climate change is expected to increase pressure on water availability especially in in the regions of Attica, Central Macedonia, Thessaly, East Macedonia-Thrace and the South Aegean islands (MoEE, 2016).

Greece has one of the highest rates of water abstraction per capita in the OECD (Figure 1.13). Agriculture accounts for 80% of water abstraction, putting pressure on aquifers. Agricultural water use, mainly for irrigation, benefits from partial cost recovery and reduced electricity prices (Section 3.3.2), which encourage inefficient use of the resource (National Bank of Greece, 2015). Public water supply accounts for 17% of water abstraction. Owing to leakage in the distribution system, Greek consumers are among the largest consumers of drinking water in Europe. Greece has increasingly relied on desalination to reduce islands' dependence on water delivered by tankers. Desalination capacity represents about 0.1% of the country's renewable water resources (IRENA, 2015).

Figure 1.13. Water abstraction levels are high



a) England and Wales only.
Source: OECD (2019), "Water: Freshwater abstractions", *OECD Environment Statistics* (database).

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Water quality

The second RBMPs show that slightly more than 60% of surface water bodies have good or better ecological status, 30% did not achieve good status and the status of 9% is unknown. Coastal waters and rivers seem to have better status than lakes and transitional waters, whose status is mostly unknown. About 89% of surface water bodies (by number of water bodies) have good chemical status, while 2% fail to achieve good status. Groundwater quality is relatively high: 85% of groundwater bodies achieve good chemical status, with lower rates in Attica (67%), Eastern Peloponnese (74%) and the Aegean islands (76%), while 84% have good quantitative status, with lower rates in Thessaly (70%) and the Aegean islands (76%).

Greece established a national monitoring network for qualitative and quantitative water status, compliant with the WFD, in 2012 and a national water abstraction register in 2014. However, due to changes in monitoring methods, comparison of water status between the first and second RBMPs is not possible.

The first RBMPs identified diffuse pollution and agricultural abstraction as the main pressures on water (EC, 2018d). In addition to pollution by nutrients and pesticides, groundwater is threatened by salinisation caused by intensive groundwater pumping in coastal areas, leading to seawater intrusion. The RBMPs identified a range of measures to address pressures from agriculture, including regulatory changes and information improvement. However, it is unclear if these measures are sufficient. Water saving measures mostly focus on improving irrigation efficiency, but such technical approaches have been found ineffective in some instances (OECD, 2017). Under the Rural Development Programme, investment in irrigation infrastructure helped slightly reduce water abstraction per hectare of cultivated area between 2015 and 2018, though the volume abstracted for irrigation increased (AUA, 2019). Overall, the net effect of agri-environmental measures on water savings and quality would require a more detailed assessment.

Greece has high compliance rates with Drinking Water Directive requirements. Most bathing waters are of excellent quality (EEA, 2019b).

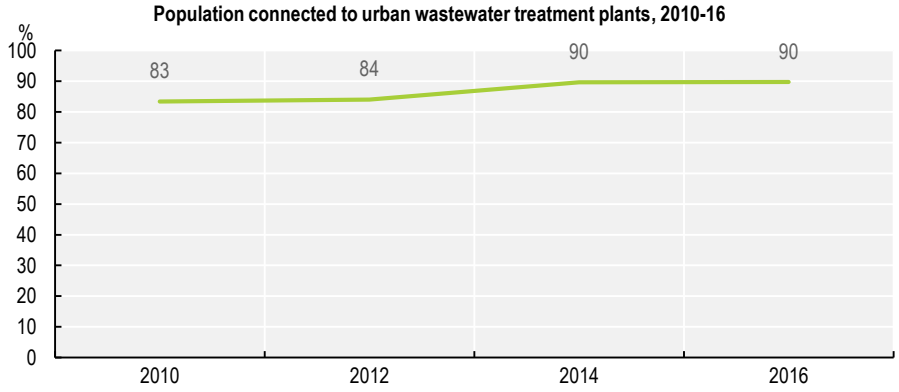
Public water supply, sanitation and sewage treatment

The majority of the population is connected to public water supply but service performance has room for improvement, particularly with regard to distribution leakage, which might create health hazards. The

European Commission projects that nearly 6% of the Greek population could potentially suffer from health problems due to unsafe drinking water by 2050, a drop from about 7% in 2015 (EC, 2018e).

Greece has made progress in wastewater treatment in large agglomerations (Figure 1.14). However, a significant share of wastewater (10% of the generated load) is dealt with by individual systems which should be replaced by collecting systems and treatment plants where population density is high enough (EC, 2017c). Investment of around EUR 1.6 billion is needed to ensure that wastewater in agglomerations is properly collected and treated (EC, 2019).

Figure 1.14. Urban wastewater treatment has progressed



Notes: Data are expressed in population equivalent (p.e. or the organic biodegradable load having a five-day biochemical oxygen demand – BOD5 – of 60 g of oxygen per day) and referring to agglomerations larger than 2 000 p.e.
Source: OECD (2019),"Water: Wastewater treatment", *OECD Environment Statistics* (database).

Recommendations on air and water management, waste and circular economy

Air quality

- Swiftly adopt and implement the national air pollution control programme to comply with standards for protection of human health; further promote replacement of inefficient oil and biomass heating systems.
- Further improve the air quality monitoring system and develop knowledge of the drivers of air pollution and its impact on health.

Waste and circular economy

- Close and remediate the remaining illegal landfills without further delay.
- Build treatment facilities for the main hazardous waste streams.
- Improve the quality of waste statistics and the oversight of extended producer responsibility systems.
- Extend separate collection of waste, including biowaste, by establishing minimum service standards. Expand the use of “pay as you throw” systems as part of instruments to encourage people to reduce waste. Ensure effective implementation of the new waste pricing policy.
- Strengthen the institutional and policy framework to speed up the transition towards a circular economy by all economic sectors.
- Swiftly establish a system for collection and safe disposal of empty pesticide containers and promote farmer education about pesticide risks. Develop an extended producer responsibility system for agricultural plastics.

Water management

- Continue to improve water monitoring to build consistent time series of data on water abstraction and quality.
- Complete the infrastructure for the collection and treatment of urban wastewater in line with the EU requirements.
- Implement the action plan to protect water against pollution caused by nitrates from agricultural sources in all vulnerable areas.
- Further assess the impact of agri-environmental measures on water and biodiversity to improve their design in Greece’s Strategic Plan under the Common Agricultural Policy 2021-27.

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Notes

[1] Between 2010 and 2018, Greece received EUR 288.7 billion in loans from its European partners (EUR 256.6 billion) and the International Monetary Fund (EUR 32.1 billion) that were conditional on implementation of comprehensive reform programmes.

[2] Mining, manufacturing, energy and water.

[3] Despite its low crude oil production, Greece has significant refining capacity and thus is a net exporter of oil products.

[4] The ratio of people aged 65 or older to the working age population.

[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] The annual level of tonne-kilometres performed per truck is low and the share of vehicle-kilometres travelled by empty vehicles is high.

[7] The others are delivering economic growth and efficiency, improving transport connectivity, providing accessibility and social inclusion, and maintaining a safe and secure transport system.

[8] The programme was due by April 2019, according to 2016/2284/EU.

[9] The sum of domestic raw material extraction used by an economy and its physical trade balance (imports minus exports of raw materials and manufactured products).

[10] The Waste Framework Directive sets out four alternative calculation methods to verify compliance with the target. According to the method chosen by Greece, the “preparation for reuse and recycling” rate was 31% in 2017.

[11] Greece has benefited from a four-year derogation to comply with the Landfill Directive. By 2010, biodegradable municipal waste going to landfill was to have been reduced to 75% of the total amount of biodegradable municipal waste generated in 1995. The share was required to be reduced to 50% by 2013 and 35% by 2020.

[12] As of mid-2018, 14 illegal landfills were still in use, 24 sites were not in use but had not been restored, and 19 had been restored but not fully closed in accordance with the legal framework.

[13] All equipment should have been tested by 2016 under the Sustainable Use of Pesticides Directive (2009/128/EC).

[14] Using harmonised international data for the denominator, the percentage of marine protected areas in Greece is less than 5% (OECD 2019c).

2 Environmental governance and management

Greece has a decentralised system of environmental governance. The government has made significant efforts to increase transparency and accountability and to streamline environmental legislation so as to reduce the regulatory burden on enterprises. However, institutional capacity issues and resource constraints limit effective implementation of environmental law and use of good regulatory practices, particularly in compliance assurance. This chapter analyses the institutional and regulatory framework for environmental management, the setting and enforcement of environmental requirements, and mechanisms of public participation in decision making, access to environmental information, education and justice.

2.1. Introduction

Greece was deeply affected by the 2010-13 financial and economic crisis, and the recession did not end until 2017. Financial austerity measures imposed as a condition of the European Union (EU) bailout led to drastic cost reductions for government agencies as well as a drive to reduce the regulatory burden on businesses. The World Bank's Worldwide Governance Indicators suggest that the rule of law in Greece receded significantly between 2007 and 2017. The indicator of government effectiveness (quality of public services) also deteriorated; it started to improve in 2012 but by 2017 had still not reached its 2007 level (World Bank, 2019) due to the government downsizing and partial deregulation.

Environmental governance was also affected. Human resources at the national and subnational levels have been strained by the massive regulatory changes since 2011 and efforts to stay abreast of EU directives. Efforts to modernise environmental regulations while protecting businesses often came at the expense of compliance assurance.

2.2. Institutional framework for environmental governance

Greece is a unitary state with a decentralised system of environmental governance. Territorial reform in 2011 resulted in seven decentralised administrations exercising devolved state powers in one or more regions and enjoying administrative and financial autonomy. Local self-government has two levels, regional and municipal, with no hierarchical relationship between them. The 13 regions and 332 municipalities are administratively and financially independent. Decentralised administrations supervise local governments only with regard to the legality of their actions, not the substance of their policies.

2.2.1. Central government and horizontal co-ordination

Key environment-related functions of the central government are concentrated in the Ministry of Environment and Energy (MoEE). The 2009 merger of the environment and energy ministries increased the influence of environmental administration and raised the profile of climate change policies. This was in line with a recommendation of the 2009 Environmental Performance Review (EPR).

The MoEE has general secretariats for natural environment and water, spatial planning and urban development, energy and raw materials, and waste management co-ordination. The decentralised administrations have general directorates for spatial and environmental policy and for forestry and agriculture.

Other ministries develop and implement policies affecting the environment. The powerful Ministry of Development and Investments is responsible for industrial policy as well as general regulation of business activities. It has led the deregulation effort of recent years. Other key government stakeholders are the Ministry of Rural Development and Food (fisheries, aquaculture and environmental policies for agriculture), Ministry of Maritime Affairs and Insular Policy (sustainable development of islands, coastal and marine protection), Ministry of Interior (oversight of local governments), Ministry of Infrastructure and Transport, and Ministry of Tourism.

There are a number of horizontal co-ordination mechanisms on environmental matters. Protection and sustainable management of natural capital and transition to a low-carbon economy constitute one of the government's eight national priorities related to implementation of Sustainable Development Goals (SDGs). The former General Secretariat of the Government, now merged in the Presidency of the Government, played a key role in ensuring a whole-of-government approach to implementing SDGs. An Inter-ministerial Co-ordination Network for the SDGs, established in 2016, brings together focal points of all line ministries responsible for mainstreaming SDG-related issues into sectoral legislation, policies and

programmes (Government of Greece, 2018a). In addition, the General Secretariat for Co-ordination is responsible for planning and monitoring implementation of the government's work across ministries.

An environment ministry decision in 2012 set up the Greek Environmental Network (GEN) to ensure exchange of environment-related information and experience among 10 central government authorities, the 13 regional General Secretariats of Development Planning and other organisations involved in programmes and projects financed by European structural and investment funds. The GEN monitors achievement of EU and national environmental targets. It is a member of the European Network of Environmental Authorities and Managing Authorities (MoEE, 2017).

Issue-specific co-ordination and stakeholder consultation mechanisms at the national level include the Inter-ministerial Committee on Energy and Climate, National Climate Change Adaptation Committee, National Council on Water (chaired by the minister of environment and energy), National Council on Circular Economy and National Council for Spatial Planning. These bodies include representatives of relevant ministries as well as other stakeholders.

2.2.2. Local governments

Every regional authority has a directorate for development planning, environment and infrastructure. Regions sometimes produce strategies and plans on key environmental issues. They are also responsible for issuing permits for certain types of activities (mainly those covered by "standard environmental obligations", Section 2.3.2) and ensuring compliance with them.

Municipalities are responsible for environmental services (water supply, wastewater and waste management) and planning and maintenance of green spaces. They collaborate within 15 solid waste management bodies created as part of regional waste management plans, in line with good practice followed by many OECD countries (e.g. Sweden, Hungary, Luxembourg).

Although central, regional and local government responsibilities are defined legislatively, their practical division is not always clear, leading to implementation gaps or overlap (IEEP, 2019). To address this issue, in 2018 the MoEE and Ministry of Interior established five Inter-ministerial Committees for Redefinition of Responsibilities and Procedures to review the jurisdictions of decentralised administrations and local governments in the area of environment. They are looking at general policy, spatial planning, energy and raw material policy, water policy and inspections.

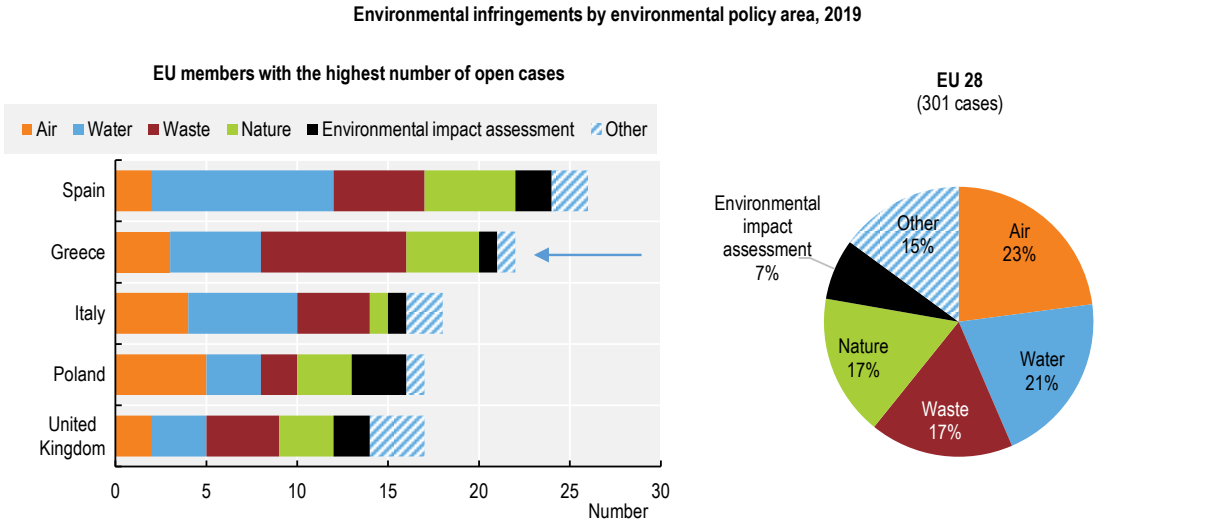
2.3. Setting of regulatory requirements

Since the financial and economic crisis, Greece has updated and streamlined core environmental legislation to meet EU and wider international obligations and enhance coherence. The main driver of this process was a desire to facilitate investment and create a business-friendly environment by simplifying planning and licensing procedures to reduce the administrative burden on the regulated community (Giannakourou, 2016). Key environmental legislation adopted over the last decade includes Law 3937/2011 on biodiversity protection, Law 4014/2011 on environmental permitting, Law 4042/2012 on environmental protection through criminal law and Law 4269/2014 (amended in 2016) on regional and urban planning. Frequent changes to environmental regulation have led nonetheless to legal uncertainty for businesses.

In 2018, Greece had 23 open cases of EU environmental law infringement, second only to Spain (32). More than a third related to waste: between 2014 and March 2019, Greece paid EUR 85 million in fines for non-compliance with EU waste legislation. Water- and biodiversity-related non-compliance accounted for about a quarter of infringements each (Figure 2.1). Greece also had 11 cases of ongoing non-compliance with environment-related rulings of the EU Court of Justice, more than any other member state

(EC, 2019a). This may be explained by a shortage of human resources to deal with the EU environmental acquis and by the lengthy and complicated procedures of the Greek public administration (EC, 2019b).

Figure 2.1. Greece has many infringements of EU environmental law, especially on waste



Note: Pending infringements as of 6 June 2019.
Source: EC (2019), *Infringement decisions* (database).

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2.3.1. Regulatory and policy evaluation

According to the 2019 Law on the Executive State, regulatory impact assessment (RIA), including public consultation, is obligatory for all primary laws as well as for subordinate regulations, such as presidential decrees and ministerial decisions, of major social or economic importance. It is overseen and evaluated by the Better Regulation Office of the Presidency of the Government. RIA includes analysis of impact on natural, urban and cultural environment. Results are published on the parliament's website.

However, RIA quality is poor due to the short period in which drafts are developed. Greece ranks among the bottom five OECD countries for quality of RIA of primary laws and subordinate regulations (OECD, 2018). Cost-effectiveness analysis is most often used instead of cost-benefit analysis in the assessment process.

Ex post evaluation of legislation must be conducted within five years of a law's entry into force. Several ministries, including the MoEE, have carried out such evaluation in updating plans and programmes. It is envisaged in a 2019 law on government operations. However, such evaluation is not yet part of established management tools in Greece. One reason is a lack of systematic information on policy and law implementation.

Strategic environmental assessment (SEA), introduced in 2006, is conducted for large-scale environment-related plans and programmes, sectoral strategies, all spatial plans, and all programmes financed by EU structural and investment funds, as envisaged by the OECD Council Recommendation on the Assessment of Projects, Plans and Programmes with Significant Impact on the Environment. SEA includes online public consultation organised by the competent authority. In recent years, SEA has been conducted on the National Hazardous Waste Management Plan; the National Strategic Plan for Transport; the Operational Programme on Transport Infrastructure, Environment and Sustainable Development; regional waste management plans; and river basin management plans. SEA reports are available to the public.

2.3.2. Environmental impact assessment and permitting

The 2011 Law on Environmental Permitting and over 25 related regulations combined the EIA and permitting processes and significantly modified EIA requirements. The reform also incorporated hazardous and non-hazardous waste management and wastewater discharges, which previously were permitted separately, into the Approval of Environmental Terms, an integrated environmental permit issued according to a uniform process.

Activities are classified as A1 for strong potential environmental impact, A2 for less significant impact or B for low impact. In Natura 2000 areas, a special ecological assessment is required (Chapter 5). The reform made EIA and a permit required only for category A activities, with the MoEE issuing permits to A1 operators and the decentralised administrations to A2. Category B activities are subject to standard environmental obligations (SEOs, often referred to internationally as general binding rules) and do not undergo EIA. SEOs are usually attached to construction or operating permits issued by the local authority. The MoEE so far has developed more than 25 SEOs for different activity types (e.g. petrol stations, hotels, hospitals, olive oil mills). They include operational as well as environmental impact standards (Stoumpidi and Adam, 2018). The use of SEOs is consistent with good international practice: general binding rules have been successfully applied in the Netherlands, the UK, Latvia and several other OECD countries.

The introduction of SEOs for low-impact facilities that previously required a permit was part of the administrative simplification reform; such facilities account for about 70% of regulated installations. This, together with the simultaneous quasi-elimination of preliminary environmental assessment for large projects, significantly reduced the number of EIA cases and the average time to complete the permitting procedure. The law sets strict time limits on the EIA and permitting process: six months for A1 projects, four months for A2. The number of EIAs for A1 and A2 activities dropped by almost 60% in 2012-13 compared to the 2005-09 average.[1] Permit applications are now submitted electronically. These changes were in line with OECD recommendations to reduce the administrative burden of environmental regulation (OECD, 2014) and the 2009 EPR recommendation to streamline the EIA process. However, the low quality of environmental impact studies is a concern.

Environmental permits are valid for 10 years. The term is extended to 12 years if the facility is certified to the ISO 14001 environmental management system (EMS) standard or 14 years if certified to the EU Eco-Management and Audit Scheme (EMAS, Section 2.4.4). However, permits are sometimes extended through special regulations, without appropriate EIA. For example, in 2018 the practice was applied to existing hotels, power plants on islands not connected to the continental grid, and quarries (WWF, 2018; 2017).

The MoEE recently created a web-based Digital Environmental Registry allowing project proponents, government stakeholders and the public to monitor the process of issuance, amendment or renewal of integrated permits and SEOs. Environmental impact studies are uploaded on the website for public comment. The registry covers A1 and A2 activities. A separate MoEE website contains a database of all approved environmental permits.

2.3.3. Land-use planning

Greece does not have a land cadastre, despite attempts to develop one since 1994. The authorities have committed to complete the cadastre and an associated land register by mid-2021. The work is supported by the European Commission and the World Bank. As intermediate steps, Greece completed draft forest mapping for most of the country in 2019 and intends to fully establish the cadastral agency and complete 45% of the cadastral mapping by mid-2020 (EC, 2019c).

The 2014 Law on Regional and Urban Planning, amended by the 2016 Law on Spatial Planning and Sustainable Development, reorganised and reduced the number of planning levels. It also revised the

content of framework and regulatory plans and introduced a new land-use classification, in line with good international practice.

Greece has five levels of spatial planning and several types under each, by far the most of any OECD country. Some have been legally abolished but remain in effect because they have not yet been replaced. There are many special plans for different types of urban development, some of which overlap: the same area may be covered by four types of zoning plans (OECD, 2017).

The national government has by far the most important land-use planning responsibilities. It approves almost all spatial plans, including 12 Regional Spatial Planning Frameworks and the master plan for Athens, which also covers the Attica region. Of the 25 of spatial plans, 22 are approved by the national government. Regions have only an advisory role in the elaboration of some spatial plans (OECD, 2017). A National Spatial Strategy required by the 2016 law has not yet been developed; the General Framework for Spatial Planning, issued in 2008 under the previous (1999) planning law, is still in force.

Greek planning laws also provide for sector-specific national planning frameworks for a range of sectors (e.g. for industry, promotion of industrial and business parks, and aquaculture). In 2017, the Council of State invalidated the national Spatial Planning Framework for Tourism without reverting to the previous one, leaving tourism development to be regulated only by regional and local plans (WWF, 2017). A new spatial planning framework for tourism was planned for 2019 but has been delayed. Other sectoral spatial plans in the pipeline are expected for industry (2020), mining (2020) and renewable energy sources (2020).

The MoEE approves Regional Spatial Planning Frameworks in consultation with regional councils. The planning frameworks were recently revised for 8 of the 13 regions. Environmental non-government organisations (NGOs) have criticised some of these. It was claimed that that of Crete, for instance, disfavoured wind and solar power development and overlooked the potential impact of new oil and gas extraction programmes off the island's west coast (WWF, 2018) (Chapter 5).

Special planning regimes with associated building rules and licensing procedures have been introduced to enable development of public and private land. In 2013-15, presidential decrees established two Special Spatial Development Plans of Strategic Investments and five Special Spatial Development Plans of Public Estates. They are approved by the Inter-ministerial Committee for Strategic Investments, which has the authority to fast-track strategic investment projects. Such plans may override regular plans and expedite environmental permitting (OECD, 2017). Special treatment of this type increases the risk of environmental degradation.

Local spatial plans, introduced in the current form in 2014, are approved by presidential decree. They must take into account environmental protection rules for sensitive areas, biodiversity considerations and sector-specific restrictions, such as limits on proximity to residential areas. SEA of local spatial plans must be approved by the MoEE if the area includes a Natura 2000 site; otherwise the decentralised administration is responsible. However, as of mid-2019 none of the envisaged 355 new local spatial plans had been completed. Their elaboration is expected to be financed by a European Investment Bank loan (EC, 2019c).

Illegal construction, including in coastal and forest areas, is a particular environmental concern in Greece despite measures (such as electronic identity of buildings) designed to limit it. In most cases, the owners face low fines: the older the construction, the lower the fine. Illegally built structures are rarely demolished but instead are legalised retroactively. For example, it has been proposed that "housing agglomerations" (mostly illegally constructed buildings) be retroactively exempted from a ban on housing development on forest land (WWF, 2017). There is no administrative permitting procedure to validate the compliance of a new structure with existing land-use plans (OECD, 2017).

To address this issue, the 2009 EPR recommended reducing building and housing construction without prior planning, ensuring adequate control and strictly enforcing the legal framework regarding construction without a building permit. However, this recommendation has not been fully implemented. A new spatial planning framework for marine and coastal areas was adopted in 2018, a National Maritime Spatial

Strategy is under preparation for 2020, and maritime spatial plans are expected to be completed by 2021. However, Law 4495/2017 on the built environment preserved exemptions and opportunities for retroactive legalisation for illegal housing development (WWF, 2018). Greece has not ratified the 2008 Protocol on Integrated Coastal Zone Management to the 1976 Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean.

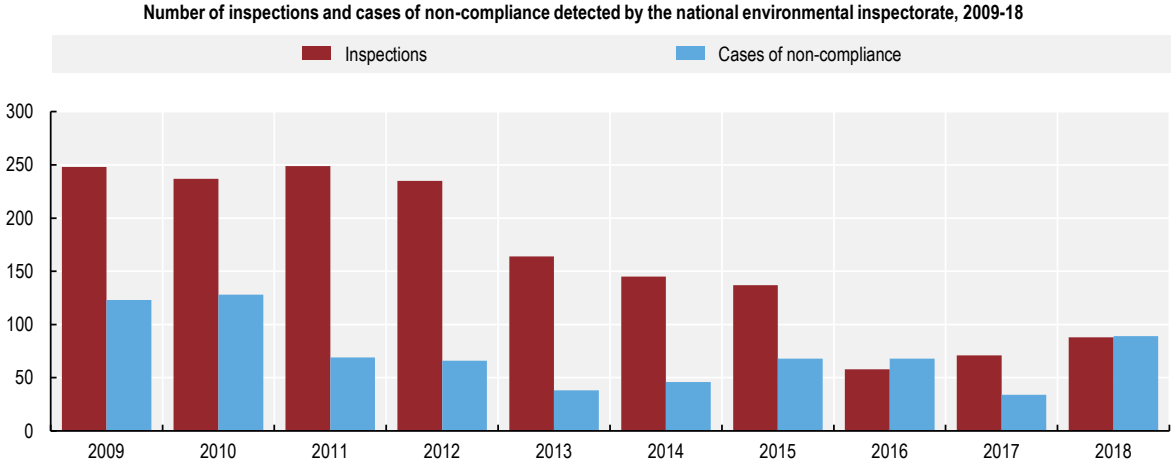
2.4. Compliance assurance

The detection rate for environmental non-compliance is high by international comparison: most inspections in recent years have discovered violations (Figure 2.2). Despite the widespread non-compliance, the 2018 Law on Supervision of Economic Activities calls for "ensuring a more effective balance" between environmental protection and business interests. Environmental protection is one of seven domains of the supervision law. It requires inspectorates to revise their methods and procedures by using such tools as risk assessment, inspection checklists and complaint management, all of which are good practice. The law also creates an opportunity to enhance the use of compliance promotion instruments. However, de-emphasising sanctions presents a risk of further weakening of environmental enforcement.

2.4.1. Environmental inspections

The Hellenic Environmental Inspectorate (EI), initially a separate service, joined the MoEE's other inspection services (for mining, energy, and building activities) in 2014 as a single body with various thematic departments. It became part of the ministry in 2017. The EI has the power to inspect any activity in the country, but the number of inspectors fell from 35 in 2011 to 15 in 2018. The number of inspections at the national level declined from 313 in 2008 to 88 in 2018 (Figure 2.2). This is contrary to the 2009 EPR recommendation to strengthen the financial and human resources devoted to the Environmental Inspectorate.

Figure 2.2. The number of national-level inspections has dropped despite high non-compliance



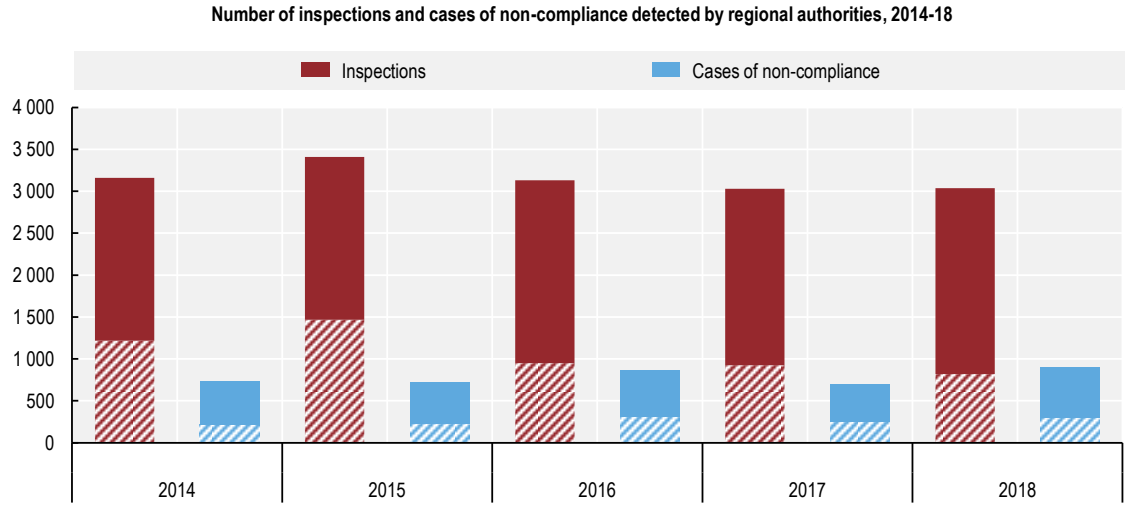
Note: Some non-compliance cases registered in a certain year may correspond to a prior year's inspection.
Source: Country submission.

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The majority of inspections are carried out by regional authorities, which had a total of 210 inspectors in 2018. In 2014-18, regional authorities conducted about 3 000 inspections per year, primarily of A2 and B activities. The Attica region, with 27 inspectors, accounts for roughly a third of the inspections performed

by regional authorities (Figure 2.3). Some 25-30% of Attica inspections identify violations – a high non-compliance rate. Decentralised administrations have the authority to conduct inspections but rarely do so despite having 88 relevant staff across the country (who predominantly deal with EIA and permitting). Criminal investigations are conducted by the EI or by the police under supervision of the public prosecutor.

Figure 2.3. Regional authorities maintain a stable inspection presence, with Attica playing a major role



Note: The striped bars correspond to inspections and cases of non-compliance related to the Attica region.
Source: Country submission.

StatLink https://doi.org/10.1787/888934155554

The 2011 laws on environmental licensing and on building permits provide for outsourcing of certain compliance monitoring functions to private environmental inspectors (auditors), certified and operating under environment ministry supervision. This practice is expected to be put into effect in 2020.

The publication in 2017 of the country's first five-year national environmental inspection plan (2018-22) is a positive development. Covering all 21 national and regional environmental inspection authorities (the EI, 7 decentralised administrations and 13 regional authorities), it aims to organise and prioritise inspections across Greece. It assigns 5% of the inspection load to the EI, 68% to regional authorities and 27% to decentralised administrations. However, in 2018 the EI carried out only 43% of its target inspection load and the regional authorities 24%. The EI acknowledges the need for a midterm evaluation of the plan to reflect lessons learned from the first years of its implementation.

The national plan prescribes inspection frequency varying from one to ten years depending on type and size of activity, sensitivity of the local environment and the operator's compliance record and environmental management certification. A digital registry contains over 6 000 projects and activities subject to environmental inspection. Prioritised based on risk assessment, 46% of them are supposed to be inspected once every ten years and 28% once every five years (IEEP, 2019). Routine inspections of business parks are limited to once in two years. This is part of the government's policy of promoting and protecting business parks (through spatial planning, permitting and other legislation), often at the expense of environmental considerations.

In practice, the vast majority of inspections are unplanned. Inspections ordered by the minister, public prosecutor or another government authority, or conducted at the inspectorate's initiative, accounted for 72% of EI compliance monitoring in 2017. Still, the share of planned inspections that year (28%) was much

higher than in 2016 (13%). In the Attica region, 90% of inspections responded to complaints. Compliance monitoring thus does not follow risk-based planning.

2.4.2. Enforcement tools

When inspectors identify non-compliance, they may impose administrative sanctions. They also forward their report to the public prosecutor, who may decide to open criminal proceedings. Environmental inspectors have preliminary investigative powers for environmental crimes, as do the police. A 2017 presidential decree established environmental protection departments within the Attica and Thessaloniki police security divisions. In exceptional cases (e.g. dealing with organised crime) the departments' jurisdiction may extend over southern and northern Greece, respectively.

Administrative fines range from EUR 500 to EUR 2 million, depending on the type, seriousness and frequency of the violation. Fines for environmental non-compliance are paid into the general budget. The EI has developed an algorithm to calculate administrative fines, taking various factors into account. A fine can be halved if the violator returns to compliance before it is imposed, or increased for a recurrent offence.

In 2017, the average fine imposed by the EI in 23 cases was more than EUR 29 000, much higher than in most OECD countries. Collection of fines, however, is a significant problem, with just 65% of imposed fines collected in 2017. A collection procedure introduced in 2019 envisages a link between the enforcement authority and the Ministry of Finance collection service to facilitate monitoring of penalty payments. Revenue from fines for illegal construction (which also have a poor collection rate) is channelled to the Green Fund (WWF, 2017).

Criminal penalties range from three months to two years of imprisonment (ten years for crimes that cause serious injury or death), in addition to judicial fines of up to EUR 500 000. Greece does not have specialised courts for environmental cases. There are no nationwide statistics on environmental crime, but waste-related crimes appear to account for the largest share. More generally, no information is collected on the effectiveness of compliance assurance interventions: outcome indicators are not part of the EI annual reports (EC, 2017). In 2020, an EU-supported project began to develop a national plan on environmental crime.

2.4.3. Environmental liability

Liability for damage to the environment

The 1986 Framework Law on the Environment establishes strict liability for environmental damage (fault-based for damage to biodiversity). Responsible parties must cover all expenses incurred by the government to remediate environmental damage. Presidential decree PD148/2009 transposed the EU Environmental Liability Directive (ELD, 2004/35/EU) into Greek law and specified criteria for assessing and remediating environmental damage. Over 2011-18, Greece reported 120 cases of damage to land, water or biodiversity.

The EI's Co-ordination Office for Mitigation of Environmental Damage (SYGAPEZ) is the authority responsible for ELD implementation in Greece. It is supported by 13 regional committees on environmental damage. The public prosecutor, an individual or NGO, or another legal entity may report a contamination incident to SYGAPEZ so that it can order remediation measures. SYGAPEZ maintains a register of environmental liability cases but it is not available to the public.

Financial security is mandatory for operators with high environmental risk but has so far been implemented only for hazardous waste management activities. For other high-risk activities, limits and conditions for insurance or other financial guarantees to cover liability risk are being elaborated. The limited implementation to date places a significant burden on the state for environmental remediation if the responsible party is insolvent.

Contaminated sites

Illegal waste landfills account for a large share of contaminated sites. Rehabilitation of many illegal landfill sites, primarily on small islands, is starting only now. Recording and initial assessment of industrial and hazardous waste contaminated sites in several regions were completed in 2017. Decentralised administrations are required to develop and publish action plans on closing illegal landfills, but more systematic work is needed. Greece has been fined by the EU Court of Justice for illegal landfills. As of June 2018, 14 illegal landfills were still in use, 24 were not in use but not remediated, and 19 were remediated but not properly closed. Full remediation and closure are planned by the end of 2020 but are likely to be delayed.

Normally, once SYGAPEZ determines that remediation is needed, its cost is initially covered by the Green Fund (an MoEE entity funded mostly by fines for environmental offences), then recovered from the responsible party if it can be identified. However, there is no coherent legal framework that would lay out a process and standards for soil remediation. SYGAPEZ, in collaboration with the Green Fund and decentralised administrations, puts together an annual funding programme for remediation of abandoned hazardous waste sites (those for which a responsible party cannot be found) in environmentally sensitive areas. Some remediation work on hazardous waste contaminated sites has been financed by the EU as part of the Operational Programme on Transport Infrastructure, Environment and Sustainable Development. The programme to close illegal landfills is supported entirely by EU funds.

2.4.4. Promotion of compliance and green practices

Compliance promotion is encouraged by the 2018 supervision law and is starting to get attention from the MoEE. Guidance on good environmental practice, particularly for small and medium-sized enterprises (SMEs), is largely lacking.

Voluntary business initiatives

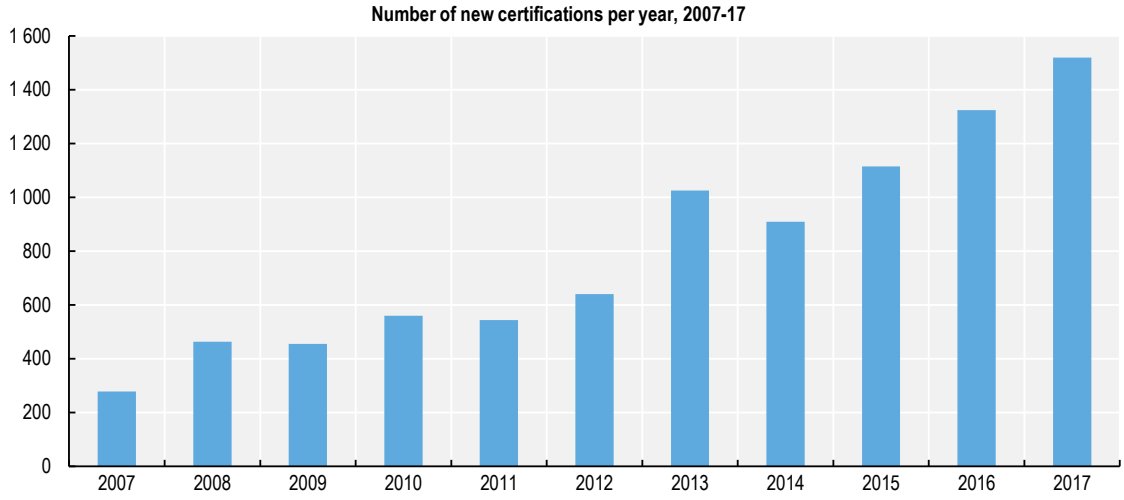
There is no systematic use of voluntary agreements. The only one concluded so far is the 2012 agreement between the MoEE and the cement industry on the use of alternative raw materials and fuels to promote resource efficiency. It was renewed in July 2019 for 4.5 years.

Since 2000, CSR Hellas, a non-profit business association, has promoted corporate social responsibility. Its current emphasis is on advancing the concept of circular economy and integrating it into legislation. In 2017, the Ministry of Development and Investments drew up a National Strategy on Corporate Social Responsibility and Responsible Entrepreneurship and put it forward for public consultation, but it was not adopted. The ministry is developing a new draft strategy, which would emphasise promoting corporate social responsibility among SMEs.

Environmental management system certification

The MoEE promotes the adoption by businesses of EMAS and certification to the ISO 14001 EMS standard. Validity of environmental permits is extended by two years for ISO 14001-certified operators and by four years for EMAS-certified ones. There is a 50% reduction in licensing fees for EMAS-certified waste management companies and a 50% reduction in environmental liability insurance premiums for EMAS holders. At the end of 2017, the national EMAS registry covered 36 companies and organisations with 1 333 sites across Greece. The number of ISO 14001-certified operators more than quintupled over 2007-17, largely due to growing market demand for green certification (Figure 2.4).

Figure 2.4. ISO 14001 certification has been steadily increasing



Source: ISO (2018), *ISO Survey 2017*.

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Greening public procurement

Environmental non-compliance of suppliers excludes them from public procurement tenders, which is good international practice. An inter-ministerial committee for green public procurement (GPP) was established in 2010 under MoEE auspices to develop a national strategy and an action plan. A national action plan for GPP was drafted in 2012, defining environmental criteria for 18 product categories. However, it was never adopted. After GPP was highlighted in the 2016 National Strategy on Public Procurement, a new national committee on GPP was established in 2017, this time under the General Secretariat of Commerce and Consumer Protection of the Ministry of Development and Investments. A new national action plan, which is to undergo public consultation in 2020, envisages mandatory environmental criteria for five product categories (paper, cleaning products, IT equipment, air conditioning and lighting) and optional ones for five other product categories. In addition, there are GPP initiatives at the regional and municipal levels.

2.5. Promoting environmental democracy

The government has made significant efforts to increase transparency and accountability. This work is supported by public administration inspector-auditors who identify cases of corruption, maladministration, inefficiency and low-quality services across the government. Greece has been a party to the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters since 2005. It has made progress in implementing the 2009 EPR recommendation to enhance the effectiveness of public consultation and environmental information dissemination via online platforms, but there is significant room for improvement.

2.5.1. Public participation in environmental decision making

Public participation in EIA and environmental permitting for category A1 and A2 activities, in SEA and in river basin management and other planning is mandated by law. Relevant documents are posted for comment on websites of competent authorities and/or the open government portal (www.opengov.gr).

The law requires government authorities to consult the public on draft laws before their submission to the parliament. Public consultation on draft legislation takes place through exchanges with selected groups and, more recently, through the open government portal. Consultation on presidential decrees and ministerial decisions can also take place but is not mandatory. Thus many important implementing regulations, such as the one defining categories of activities for environmental permitting, have not been subjected to public comment.

When public consultation is organised, it is often too short to be meaningful, and supporting and explanatory materials on the draft may not be available (IEEP, 2019). Still, public participation at the national level is on the rise: 8 consultations conducted by the MoEE in 2015 attracted 589 public comments (about 75 per consultation), but in 2017, 2 085 comments were submitted in 13 consultations (about 160 comments per consultation) (IEEP, 2019).

The 2010 law on local government and decentralised management requires every regional and municipal administration to set up a stakeholder consultation committee that includes representatives of local business associations, trade unions, NGOs and the public. The committees express opinions on the local government's development and technical programmes and regulatory decisions.

2.5.2. Access to environmental information

The 2005 law ratifying the Aarhus Convention and a 2006 Joint Ministerial Decree provided access to environmental information for all. A dedicated 2011 law promotes e-governance in public administration, which facilitates online access to information. A 2015 presidential decree codified regulations on access to public documents and data, including environmental information. All public authorities are required to upload every administrative act on the Diavgeia (Clarity) website as a result of a major initiative by the Ministry of Interior. Refusal to comply or incomplete provision of information can be addressed in an administrative court (a special administrative committee for first-instance appeals was abolished in 2013).

The MoEE supervises the collection and publication of core environmental data, in collaboration with the Hellenic Statistical Authority. The MoEE Citizens Service Centre directs the public to the departments best able to respond to information requests. The latest State of the Environment Report was published in 2018 by the National Centre for the Environment and Sustainable Development. However, the report lacks an analysis of the main factors behind environmental trends.

Facility operators must report pollution release data annually to the MoEE Directorate of Environmental Permitting, which sends the data to the European Environment Agency for compilation and dissemination in the European Pollutant Release and Transfer Register. The MoEE has also launched a national geoportal which provides access to geospatial data.

The key barrier to accessibility and adequate interpretation of environmental information is the absence of a coherent framework for data collection, classification and maintenance. Multiple websites, some abandoned due to a lack of resources for their maintenance, offer partial, outdated or fragmented information (IEEP, 2019). Certain departments refuse public access to environmental information, claiming its publication could harm the country's economic interests (WWF, 2018).

Despite progress, such as the establishment of registries on waste generation and water abstraction, there is room to strengthen the analytical basis for policy making, as recommended in the 2009 EPR. For example, available data do not allow inference of trends in water abstraction or assessment of hazardous waste generation (Chapter 1). Progress on environmental accounts is slow (Chapter 3). In addition, Greece is often late submitting national data required by its EU obligations (EC, 2019b).

2.5.3. Access to justice

Every administrative decision is subject to appeal to the authority that issued the decision and to a higher administrative body, as well as an annulment suit in an administrative court. The Supreme Administrative Court (Council of State) is the body of final instance (after administrative courts and the Administrative Court of Appeal) for annulment of enforceable acts of public authorities on grounds of excessive power and violation of the law.

Greece guarantees broad access to justice on environmental matters for individuals and NGOs. Citizens can invoke the right to a clean environment, provided in Article 24 of the Constitution, as the basis for suits in administrative or regular courts. However, there are no special judicial procedures for environmental matters, and court procedures are very long. The cost of bringing a lawsuit is not prohibitively high, although it was recently doubled due to the financial crisis (European e-Justice Portal, 2019). There are no exemptions from procedural costs in environmental matters, but legal aid is available to low-income citizens.

The Greek Ombudsman works on "quality of life" issues (among others), which covers the environment. Its investigators work on cases of poor administrative practice at the national, regional and local levels, with a dedicated team on the environment and urban planning (Box 2.1). Another institution, the Regional and Municipal Mediator (not connected to the Greek Ombudsman's office), handles complaints against regional authorities. Both offices have audit powers and can make recommendations to the public administration, initiate disciplinary proceedings or refer the case to a public prosecutor, but cannot impose sanctions. These powers and their use regarding the environment are greater than those of ombudsman offices in some other OECD countries, such as Hungary.

Box 2.1. The Greek Ombudsman

The Greek Ombudsman is an independent authority whose office is provided for in the Constitution. It has been in operation since 1998 and provides its services free of charge. Its Quality of Life department deals with violations of environmental and land-use planning legislation, including wrongful permitting, illegal construction, illegal intervention in protected areas or the coastal zone, environmental damage and lack of access to environmental information.

In recent years, the top four areas of citizen complaints have involved licensing and monitoring of construction works, use and maintenance of public spaces, protection of natural habitats, and waste management. About 85% of public complaints addressed to the office end up being resolved by the public administration.

The Greek Ombudsman publishes annual reports and special reports on key issues, such as a 2013 report on coastal zone management, a 2016 report on entrepreneurship and environmental protection and a 2017 report on implementation of provisions legalising illegal construction. Such reports contain recommendations to the government. In addition, the office draws on specific cases to submit written proposals to competent authorities on legislative or implementation measures.

Source: Greek Ombudsman (2019).

2.5.4. Environmental education

A recent opinion poll showed that the public is concerned about the environment: nine out ten respondents said damage to the natural environment and extinction of species were a serious risk, whereas only 7% said the concerns were exaggerated. The vast majority of the public (around 80%) supports adopting stricter environmental laws (WWF, 2018).

As the 2009 EPR recommended, Greece has integrated environmental aspects in education at all levels. The Institute of Educational Policy developed a curriculum on environment and sustainable development, which was approved by the Ministry of Education and Religious Affairs (MERA) in 2015. About 80% of primary and secondary schools participate in sustainability initiatives. In 2015-16, about 440 training seminars, based on the Guidebook on Environmental Education, were organised for teachers and school officials in over 200 schools. Educational materials on environmental issues are uploaded on the Photodentro (Tree Light) platform, which is part of a digital infrastructure for educational content in schools run by the Institute of Educational Policy. Photodentro is open to students, teachers, parents and the general public.

Fifty-three Environmental Education Centres support schools in designing and using sustainability curricula that go beyond the purely environmental dimension; they also provide teachers with training and promote sustainability initiatives in collaboration with local communities (Box 2.2). In 2018, MERA established a directorate to support sustainability education in schools. At the regional level, decentralised support units of MERA promote educational programmes and projects related to the environment, health and culture.

Box 2.2. Sustainable schools

The Sustainable School label, administered by an environmental NGO, Aeiforum, is a certificate that rewards schools for sustainable practices. Introduced in 2015, it involves 40 criteria covering pedagogical, social and environmental activities and functions. Schools enrol in the programme at the beginning of a school year and submit a "sustainable school calendar" to report on a set of indicators at the end of the year. Among other requirements, the school has to create a sustainable school management plan and related activity programme. Almost 400 schools have registered in the programme, but not all have received the label.

Similar initiatives include the international Eco-Schools programme (700 participating schools in Greece) and the Greek Sustainable School, run by the Hellenic Society for the Protection of Nature (200 participating schools).

Source: Government of Greece (2018b).

The majority of Greek universities have introduced environment-related subjects in their curricula. There are five master's degree programmes on environmental education and education for sustainable development (Government of Greece, 2018b).

As a result of collaboration between MERA and the MoEE, the 36 management bodies of Greece's Natura 2000 sites (Chapter 5) have environmental education centres that conduct training and other educational activities for school students of all ages. However, there is limited financial support for environmental education, leading to a lack of technical infrastructure and specialised staff (MoEE, 2017).

Recommendations on environmental governance and management

Strengthening the institutional and regulatory framework

- Enhance collaboration on environmental matters between the national, regional and municipal governments through, among other measures, co-ordination of compliance assurance activities and information exchange.
- Expand the use of ex ante cost-benefit analysis and *ex post* evaluation of regulations, policies and programmes.
- Avoid special provisions in environmental permitting.
- Increase substantially the share of the territory covered by local spatial plans so as to limit the use of special land-use planning regimes for strategic investments and public estates; end retroactive legalisation of illegal construction; adopt and implement spatial plans for marine and coastal areas in the framework of integrated coastal zone management.

Improving enforcement and compliance

- Increase the share of planned inspections based on risk assessment at the national and subnational levels; strengthen the capacity of all environmental inspection authorities.
- Enforce payment of fines through administrative and judicial measures; better monitor and measure effectiveness of enforcement actions.
- Expand GPP and the use of voluntary agreements with industry to promote green business practices.
- Develop standards and procedures for soil remediation.

Enhancing environmental democracy

- Improve the quality and usability of publicly accessible environmental information by dedicating more resources to its collection and management; support more active public participation in environmental decision making.

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Notes

[1] EIA numbers were also affected by a decline in investment due to the economic crisis. However, this impact is difficult to quantify

3 Towards green growth

This chapter reviews Greece's efforts to mainstream environmental considerations into economic policy and to promote sustainable development. It analyses progress in using economic and tax policies to pursue environmental objectives, as well as steps taken to reform environmentally harmful subsidies. The chapter reviews efforts to scale up investment in environment-related and low-carbon infrastructure. It also examines the country's eco-innovation performance and opportunities for green industry.

3.1. The environment in economic adjustment programmes 2010-18

After a severe recession, the economy started to recover in 2017 and Greece successfully exited the European stability support programme in 2018. Between 2010 and 2018, the country received EUR 289 billion in loans[1] conditional on implementation of comprehensive reforms. The economic adjustment programmes (2010-12, 2012-14, 2015-18) initially focused on reducing the cost of labour and cutting pensions, then broadened to improving the business environment, modernising the public administration and enhancing social protection (OECD, 2018a). Greece has substantially improved its budget balance and current account balance. However, high public debt, a negative net international investment position, the scale of banks' non-performing loans and a high unemployment rate remain of concern (EC, 2019a).

The economic adjustment programmes included commitments to complete the cadastre and forest and coastal mapping, simplify environmental licensing, streamline environmental impact assessment and facilitate spatial planning, in line with OECD recommendations (OECD, 2010, 2014). Greece has made progress in advancing the cadastral and forest mapping. It has undertaken major efforts to streamline its environmental and spatial planning legislation to facilitate investment (Chapter 2). However, special arrangements, combined with reduced enforcement capacity, have weakened environmental governance. The adjustment programmes also provided for bringing energy markets into line with EU regulations, adopting a transport plan and improving the water regulatory framework. Despite progress in these areas, the economy remains highly reliant on fossil fuels, road transport is predominant and compliance with EU requirements on waste and water management is challenging.

3.2. Framework for sustainable development and green growth

In 2018, Greece renewed its commitment to sustainable development in a voluntary national review on implementation of the 2030 Agenda that was presented at the 2018 UN High-level Political Forum on Sustainable Development (Government of Greece, 2018). The former General Secretariat of the Government, which was in charge of co-ordination before the shift of power, was instrumental in adopting a whole-of-government approach to define national priorities for sustainable development (Box 3.1). Pending adoption of the first four-year implementation plan for Sustainable Development Goals (SDGs), scheduled for 2020, the 2019 National Strategy for Sustainable and Fair Growth 2030 (NSSFG) has been expected to provide the strategic reference for implementing the 2030 Agenda.

Box 3.1. The voluntary national review on implementation of the 2030 Agenda for Sustainable Development

Greece's 2018 voluntary national review on implementation of the 2030 Agenda sets eight national priorities for sustainable development. Defined through an in-depth stock-taking exercise in 2017 involving a wide array of stakeholders, they are:

1. fostering a competitive, innovative and sustainable economic growth (SDGs 8, 9)
2. promoting full employment and decent work for all (SDG 8)
3. addressing poverty and social exclusion, and providing universal access to quality health care services (SDGs 1, 2, 3)
4. reducing social and regional inequality and ensuring equal opportunities for all (SDGs 10, 5)
5. providing high-quality and inclusive education (SDG 4)
6. strengthening protection and sustainable management of natural capital as a base for social prosperity and transition to a low-carbon economy (SDGs 6, 7, 11, 12, 13, 14, 15)
7. building effective, accountable and transparent institutions (SDGs 16, 17)
8. enhancing open, participatory, democratic processes and promoting partnerships (SDGs 16, 17).

Priority 6 is broken down as follows:

- transition to a circular economy model for sustainable production and consumption patterns (SDGs 12, 8, 9)
- elaboration of an integrated environmental framework to support economic development and investment, while safeguarding and protecting natural capital and biodiversity (sustainable water resource management, SDG 6; inclusive, safe, resilient and sustainable cities, SDG 11; sustainable use of seas and of marine resources, SDG 14; protection, restoration and sustainable use of terrestrial ecosystems, SDG 15)
- transition to a low-carbon economy and adaptation to the impact of climate change (SDGs 7, 13).

Agriculture and tourism are highlighted as focus areas for enhancing policy coherence for sustainable development and promoting SDG interlinkage.

Source: Government of Greece (2018).

The NSSFG was a welcome update of the 2018 National Growth Strategy. Compared to the earlier version, it put greater emphasis on sustainable development, climate change adaptation and risk management, while keeping a focus on circular economy. It listed 40 key performance indicators, mostly relating to SDG implementation (Table 3.1). However, the coherence between environmental and economic objectives was not always clear; examples include developing both mega-yacht chartering and eco-tourism, promoting renewable energy resources along with hydrocarbon exploration, and reducing GHG emissions in the transport sector while becoming a leading regional logistical hub.

The NSSFG recognised that Greece's natural capital should be protected and sustainably managed to provide opportunities for employment, prosperity and quality of life for all. However, progress on environmental accounting is slow. Available information on environmental protection expenditure, the

environmental goods and services sector and material flow, and natural capital accounts is not sufficient to support policy making.

Table 3.1. Selected key performance indicators of the National Strategy for Sustainable and Fair Growth 2030

Key performance indicator (KPI)	Title	SDG
KPI.1	Development of a comprehensive monitoring system to track progress on SDGs by 2020	All
KPI.2	Reduction of child poverty to pre-crisis levels by 2021	1
KPI.3	Creation of at least 10 000 jobs for young researchers by the Hellenic Foundation for Research and Innovation and research programmes by 2021	9
KPI.4	Satisfaction of all demand for kindergartens by 2021	1
KPI.6	Increase in the manufacturing share of GDP to 12.5% by 2025	9
KPI.7	100% increase in R&D expenditure by 2020 (from 2011)	9
KPI.9	Provision of service of at least 100 Mbps in digitally lagging regions and for 2.5 million citizens by 2023	9,10
KPI.10	Introduction of green criteria in 10 public procurement contracts by 2020	12
KPI.13	Increase in the share of renewables in gross final energy consumption to 32% by 2030	7
KPI.14	Completion of the national cadastre by 2021	15
KPI.16	Universal access to 2 years of pre-primary education by 2020 (90% coverage in municipalities by 2019)	1
KPI.19	100% increase in foreign direct investment by 2025	17
KPI.28	Completion of the ratification of forest maps by 2021	15
KPI.29	Reduction of greenhouse gas emissions by 22.6% between 2016 and 2030	9
KPI.30	Completion of regional plans for climate change adaptation by 2021	13
KPI.32	Thessaloniki metro in operation by 2020	9,11,13
KPI.33	Creation and operation of 239 local health primary units by 2021	1
KPI.34	Modernisation and digitization of the Hellenic Labour Inspectorate for reducing undeclared work (5% in 2021)	8
KPI.35	Energy interconnection of Crete with the mainland by 2023 and all islands by 2030	7
KPI.36	Operation of the National Civil Protection System by 2021	13
KPI.38	Operation of the Hellenic Development Bank within 2019	17
KPI.39	Provision of 750 new generation buses (equipped with anti-pollution technology)	9,11,13

Source: Government of Greece (2019), *National Strategy for Sustainable and Fair Growth 2030*.

3.3. Greening the system of taxes, charges and prices

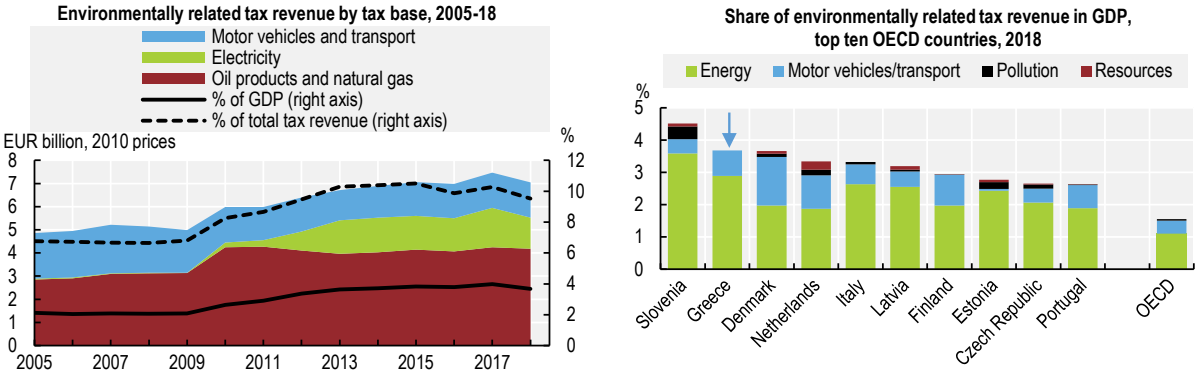
3.3.1. Environmentally related taxes: An overview

As part of its economic adjustment programmes, Greece has undertaken major reforms to remedy its longstanding weakness in tax collection and compliance (EC, 2019a). Value added tax (VAT) and personal income taxes were raised, their base broadened and compliance rates improved. In 2018, Greece was among the EU countries with the highest VAT and income tax rates, although the VAT gap[2] and outstanding tax debt[3] remain high (EC, 2018a). The ratio of tax revenue to GDP strongly increased from 31.2% in 2007 to 38.7% in 2018, well above the OECD average of 34.3% (OECD, 2019a). This trend was mostly driven by revenue from consumption taxes, which decreased less than GDP until 2013 and increased faster afterwards. Relative to the OECD average, the tax structure in Greece is characterised by higher revenue from consumption and property taxes and social security contributions and lower revenue from taxes on income, profits and gains.

In 2018, Greece recorded one of the highest levels of revenue from environmentally related taxes in the OECD at 3.7% GDP (Figure 3.1). The share nearly doubled over the decade due to increased energy

taxation. Taxes on energy products account for a larger share of environmentally related tax revenue than the OECD average (79% vs. 71%), while taxes related to transport (excluding fuels) generate relatively low revenue (21%, vs. 26% in the OECD). Greece is among the few OECD countries that do not raise revenue from other environmentally related taxes (single-use plastic bags is a recent exception). Collecting taxes on pollution and resource use could have important environmental benefits even if they did not raise much revenue.

Figure 3.1. Revenue from energy taxes increased markedly



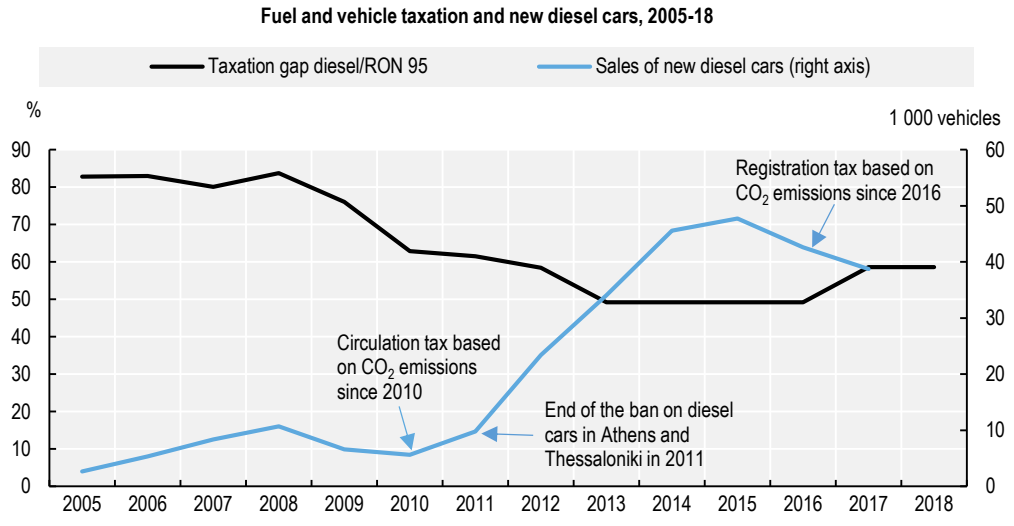
Source: OECD (2019), "Environmental policy instruments", *OECD Environment Statistics* (database); OECD (2019), "Revenue Statistics: Comparative tables", *OECD Tax Statistics* (database); EC (2019), "Data on taxation: National tax lists", website.

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3.3.2. Taxes on energy use and carbon pricing

Revenue from taxes on energy products nearly doubled over 2009-18, mainly due to increased taxation on electricity and oil products. In the early 2010s, Greece introduced excise duties on electricity and natural gas to comply with the 2003 EU Energy Taxation Directive. Although rates were not raised thereafter, special duties introduced to cover the cost of support to renewables boosted revenue from electricity taxes (Figure 3.1). Excise duties on transport fuels increased markedly between 2009 and 2010, so revenue went up despite declining oil consumption. Although diesel taxes were reduced in 2012-13, they remained higher than their pre-crisis level. Excises on oil products were increased again in 2017, placing Greece among the OECD countries with the highest prices and taxes on petrol. Greece gives preferential tax treatment to diesel relative to petrol despite diesel's higher carbon and air pollutant emissions (Harding, 2014). This is common among OECD countries, but generally to a lesser extent. The diesel/petrol taxation gap has widened since the beginning of the crisis despite a slight reduction to 59% in 2017 (Figure 3.2). This, combined with an end to a ban on diesel cars in major metropolitan areas and the introduction of CO_2 emission criteria in the circulation tax, has helped boost sales of diesel cars, though petrol cars remain dominant.

Figure 3.2. Tax differentiation has helped boost sales of diesel cars



Source: ICCT (2018), *European Vehicle Market Statistics 2018/19;* IEA (2019), *IEA Energy Prices and Taxes Statistics* (database).

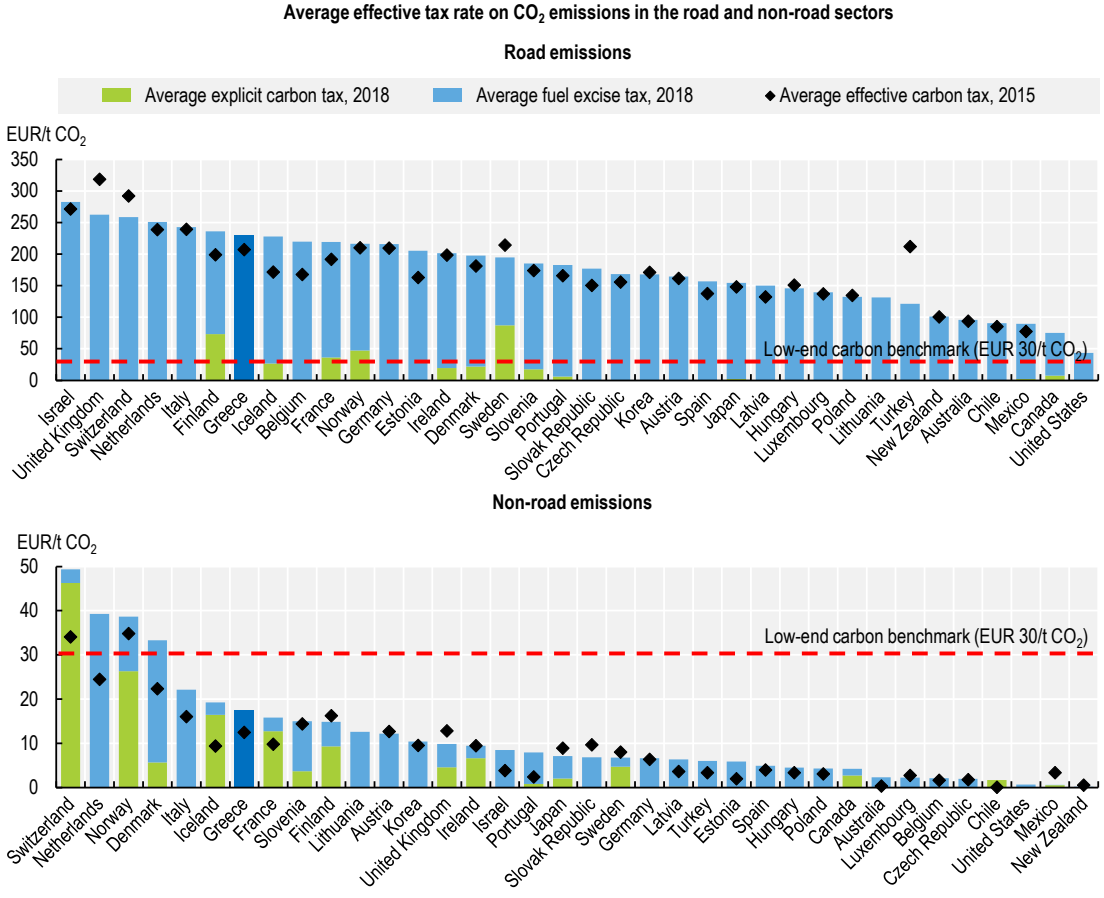
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In 2012, tax rates on heating oil and diesel were equalised to address tax fraud involving heating oil being used instead of more expensive diesel in vehicles. However, the increase in heating oil prices resulted in households switching from oil to wood for heating, with adverse consequences for air quality (Chapter 1). As a result, tax rates on heating oil were reduced over 2014-16 and disconnected from diesel. The government has been trying to tackle the issue of fuel smuggling for years (EC, 2017a). Revenue losses are estimated between EUR 250 million and EUR 3 billion annually (Energyworld, 2018; Alderman, 2015).

Greece reformed natural gas excises in 2016. Before the reform, rate levels were well above the mimima required by the EU Energy Taxation Directive and excises were imposed on natural gas used for electricity generation, which contravened the provisions of the directive and led to overlap with the EU ETS cap (EC, 2017a). The reform eliminated the taxation on gas used for electricity production, reduced taxation for household heating to the EU minimum and introduced regressive taxation for large industrial users. The reform should support gas-based electricity production against more carbon-intensive sources, encourage households to switch from oil to natural gas and reduce the double burden for energy-intensive companies covered by the EU ETS.

Overall, effective tax rates[4] on CO_2 emissions from energy use are higher than in most OECD countries (Figure 3.3). However, there remains room to review tax variation across fuels and uses, along with tax concessions (Section 3.3.3), to provide a more consistent carbon price signal. As in other OECD countries, the road sector is taxed at the highest effective rates, which is justified by the higher environmental and social costs of road transport (OECD, 2018b). In the off-road sector, however, fuels used for domestic shipping, including fishing and tourist boats, and for aviation are untaxed, in line with the Energy Taxation Directive. In the industrial sector, specific uses of coal and coke (mineralogical, chemical reduction, electrolytic and metallurgical processes) are untaxed. Fuel oil and diesel used in agriculture are taxed, but diesel used for fishing and liquefied petroleum gas are not. Oil products used to generate electricity are taxed; coal products and natural gas are not. The use of electricity is taxed except in mineralogical, chemical reduction and metallurgical processes and agriculture.

Figure 3.3. Effective tax rates on CO_2 emissions are relatively high



Note: Tax rates as applicable on 1 July 2018. CO_2 emissions are calculated based on energy use data for 2016 from IEA (2018), *World Energy Statistics and Balances*. Emissions from the combustion of biofuels are included. The average effective carbon tax rate in 2015 is the sum of the average explicit carbon tax rate in 2015 and the average fuel excise tax rate in 2015.
Source: OECD (2019), *Taxing Energy Use 2019: Using Taxes for Climate Action*.

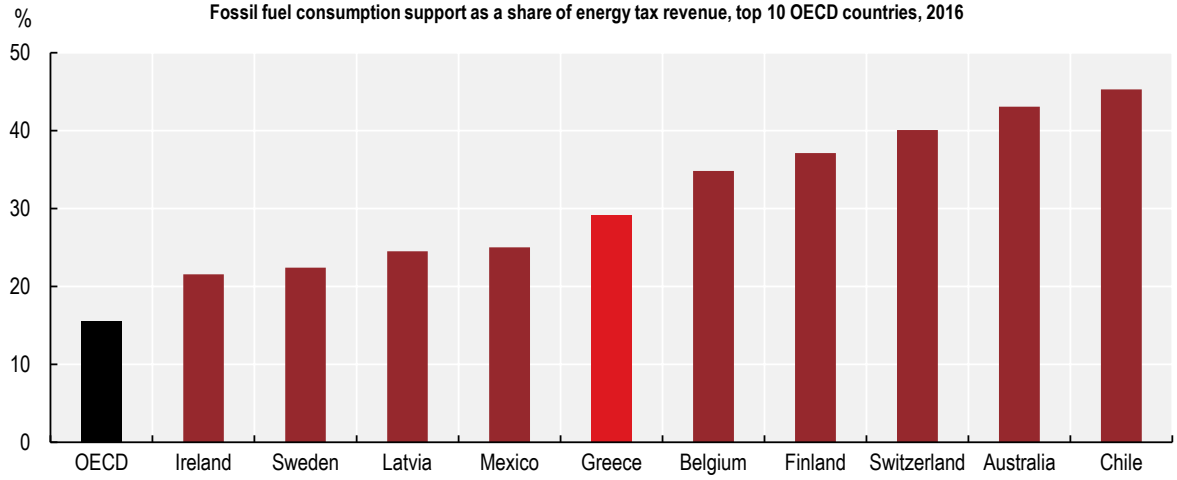
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3.3.3. Removing environmentally harmful support to fossil fuel consumption

The level of support to fossil fuel consumption expressed as a share of energy tax revenue is among the highest in the OECD (Figure 3.4).

Consumption support is mainly directed at oil products (68% in 2017), followed by coal (21%) and natural gas (11%). It rose significantly in 2010-11 as forgone revenue from tax concessions compliant with the Energy Taxation Directive (excise tax exemption on diesel for aircraft and vessels, reductions and refunds for agriculture, reduced excise on oil for heating) increased with excise duties on oil products (Figure 3.5). After 2011, related tax expenditure fell with the reduction of taxes on diesel and fuel oil and the decline in oil consumption until 2013. In a welcome move, Greece abolished tax relief for diesel used in agriculture in 2016.

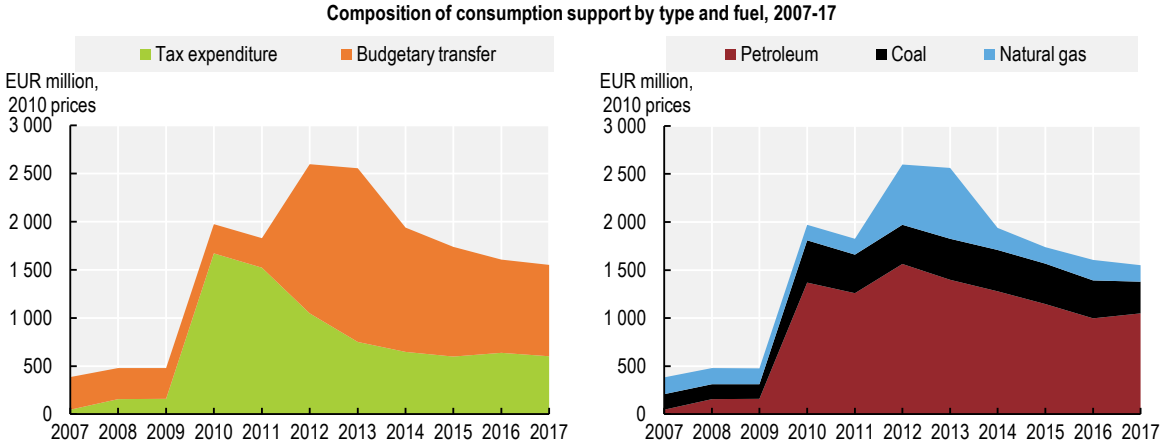
Figure 3.4. The fossil fuel consumption support level is among the highest in the OECD



Note: Data need to be interpreted with caution because fossil fuel subsidy data may be partial and because data record tax expenditure as an estimate of revenue foregone due to a particular feature of the tax system that reduces or postpones tax relative to a jurisdiction's benchmark tax system, to the benefit of fossil fuels. Hence, i) tax expenditure estimates could increase due either to greater concessions, relative to the benchmark treatment, or to a raise in the benchmark itself; ii) international comparisons of tax expenditure could be misleading, due to country-specific benchmark tax treatments. It is important to note that definitions of tax expenditure, and the benchmarks used to estimate the size of the expenditure, are nationally determined, which may hamper international comparisons.
Source: OECD (2019), *Green Growth Indicators* (database); OECD (2019), *OECD Inventory of Support Measures for Fossil Fuels* (database).

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Figure 3.5. Fossil fuel consumption support has decreased since 2012



Note: Data need to be interpreted with caution because fossil fuel subsidy data may be partial and because data record tax expenditure as an estimate of revenue foregone due to a particular feature of the tax system that reduces or postpones tax relative to a jurisdiction's benchmark tax system, to the benefit of fossil fuels. Hence, i) tax expenditure estimates could increase due either to greater concessions, relative to the benchmark treatment, or to a a raise in the benchmark itself; ii) international comparisons of tax expenditure could be misleading, due to country-specific benchmark tax treatments. It is important to note that definitions of tax expenditure, and the benchmarks used to estimate the size of the expenditure, are nationally determined and may hamper international comparisons.
Source: OECD (2019), *OECD Inventory of Support Measures for Fossil Fuels* (database).

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Since 2012, significant support to fossil fuel consumption has also been provided through budgetary transfers. This includes subsidies paid to oil-based power generators to supply electricity in non-interconnected islands at the same tariffs as the mainland, capacity payments to compensate gas- and coal-based electricity producers for availability of flexible generation and oil heating allowances paid to households. Greece should pursue interconnection of islands with the mainland transmission system or, where this is not cost-effective, install storage systems to use the renewables potential (IEA, 2017). Doing so would help meet environmental goals, enhance energy security and reduce the public service

obligation levy that all electricity consumers pay to finance the cost of service on the islands. Capacity payments have declined since their 2012-13 peak but continue to account for a significant share of budgetary transfers (33% in 2017). While such mechanisms may help ensure electricity supply security in the short term, Greece should ensure they do not slow down the low-carbon transition by favouring fossil fuel technology. Finally, replacing household oil heating allowances with direct payments not linked to the type of fuel used would help address poverty while providing incentives to switch to cleaner fuels (Section 3.3.7).

There is little information on potentially environmentally harmful subsidies and tax expenditure. The 2019 Energy and Climate Plan lists some subsidies (social tariffs for electricity, heating oil allowances, subsidies to supply electricity in non-interconnected islands) that are expected to support non-fossil energy sources with the planned increased in renewables and interconnection of islands by 2030. As part of regular spending reviews, the Directorate for Evaluation of General Government Actions of the Ministry of Finance could screen public support programmes against their potential environmental impact (OECD, 2019b). Such screening could be used in reforming subsidies and special tax treatment that are not justified on economic, social or environmental grounds.

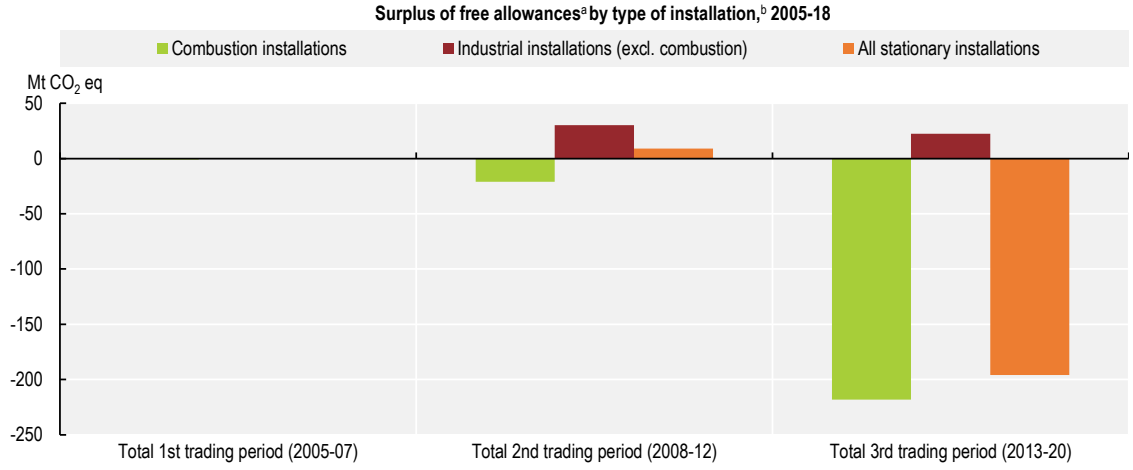
3.3.4. Carbon pricing through the EU Emissions Trading System

Greece also puts a price on CO_2 emissions via the EU ETS, although the carbon price signal has been weak until recently. In 2018, the electricity sector was responsible for 72% of EU ETS-regulated emissions, reflecting the country's carbon-intensive energy mix.

In the first two trading periods (2005-12), emission caps were determined at the national level and allowances were allocated for free. Over 2005-07, verified emissions matched allocated allowances (Figure 3.6). In the second trading period (2008-12), the power sector faced a shortfall of allowances while other industrial installations, especially in the cement industry, accumulated a significant surplus. The supply of allowances has dropped in the third period (2013-20), with the introduction of an EU-wide emission cap, the extension of auctioning and backloading of allowances. Greece has since experienced a deficit of allowances in the energy sector and a declining surplus in other industries.

The recent rise in allowance prices put the profitability of the state-owned Public Power Corporation at risk, while part of its lignite asset has to be divested to open the market under the economic adjustment programme agreed with the European Union (PPC, 2019). Greece was refused a derogation under Article 10(c) of the ETS Directive to provide transitional free allowances to its power sector. At the end of 2018, Greece removed a special levy on electricity produced by lignite and a charge on electricity suppliers to help alleviate industry losses.

Figure 3.6. A deficit of EU ETS allowances and rising prices make coal-based power costly



a) Difference between allowances received free of charge (excluding allowances bought e.g. through auctioning) and verified emissions.
b) Combustion of fuels: combustion installations exceeding 20 MW (mainly electricity generation plus various manufacturing industries). Other industrial installations include refineries and the production of iron; steel and other metals; cement and other non-metallic minerals; pulp and paper; and chemicals.
Source: EEA (2019), *EU ETS Data Viewer* (database).

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3.3.5. Transport-related taxes and charges

Vehicle taxes

While vehicle taxes are less efficient than fuel taxes and distance-based charges in reducing emissions of GHGs and local air pollutants, they can steer the fleet towards cleaner vehicles (van Dender, 2019). Transport tax revenue has decreased in real terms, driven by a sharp drop in car registrations and the growing share of used cars and trucks among vehicles put into circulation. The share of transport-related taxes in total environmental taxes was halved in ten years to 21% in 2018, below the OECD average of 26%.

Since 2016, the registration tax for new passenger cars has been based on taxable value (net retail price), CO_2 emissions and Euro emission standards. Hybrid cars benefit from a reduction and electric cars are exempt. For imported used cars, the taxable value is reduced according to the age of the vehicle and the mileage (the older the car, the lower the tax) (ACEA, 2019). The registration tax of heavy goods vehicles is not based on CO_2 emissions but is higher for trucks not meeting Euro VI standards. It is also reduced for older trucks. This is a disincentive for vehicle renewal in a country with one of the oldest fleets in Europe.

The annual circulation tax for new and imported used cars has been based since 2010 on CO_2 emissions, for vehicles registered after October 2010, or on engine capacity and date of first registration for older cars (the older the registration date, the lower the tax). Electric cars are exempt.[5] The tax on heavy goods vehicles increases with weight and does not consider environmental parameters.

Since 2012, an annual luxury living tax has been applied on ownership of passenger cars with engine capacity greater than 1 929 cc. It is based on the presumed income of the car owner.[6] As it only applies to cars less than 11 years old, this tax does not promote rejuvenation of the car fleet.

Tax treatment of company cars

Since 2016, the taxable benefit of using a company car for private purposes has been computed as a percentage of the car's pre-tax retail price and age. The imputation rate does not vary with vehicle emissions, private mileage or fuel cost, thus providing no incentive to employees to drive less. In addition, companies have had no incentive to buy cleaner vehicles or limit their use. Car expenses (depreciation, repair and maintenance, circulation tax, fuel, tolls, leasing or renting) are fully deducted from corporate income tax. The Law on Tax Reform, enacted in December 2019, introduces environmental criteria in the tax treatment of personal use of company cars: i) exemption from the individual's taxable income of the benefit from the use of low (50 g CO_2/km) or zero emission vehicles with a pre-tax retail price up to 40 000 EUR; ii) super deduction (130%) on company's expense for leasing a low or zero emission vehicle with a pre-tax retail price up to 40 000 EUR, and for purchasing, operating and installing publicly accessible charging points for low or zero emission vehicles; and iii) higher depreciation rates for low or zero emission vehicles. While the metro networks are being extended in Athens and under construction in Thessaloniki, Greece should further develop incentives to commute by public transport or bicycles. Reimbursement of a public transport pass by the employer is not considered a benefit in kind under the law on Tax Reform.

Road pricing and restriction

Road charges are levied on the entire motorway network and on specific bridges and tunnels for all vehicles. Toll levels are based on distance travelled and number of axles. Making the charge vary by vehicle emission characteristics would help address air pollution, especially if taking account of population exposure (e.g. by using population density at the place of driving as a proxy) (van Dender, 2019). A tender is under way for procurement of a full distance-based electronic system that could allow such a pricing system.

Since 2012, only Euro-5 and Euro-6 cars emitting less than 140 g CO_2/km have been allowed access to Athens's inner ring. Other cars are subject to odd/even restrictions. Vehicles over 2.2 tonnes and over 22 years old cannot enter the inner and outer rings except for buses of the Athens Urban Transport Organisation. In addition, since 2011, only Euro-5 and newer diesel cars have been officially allowed in the greater Athens and Thessaloniki areas. In practice, however, these restrictions are not enforced.

3.3.6. Taxes and charges on pollution and resource use

Greece is among the few OECD countries that do not raise revenue from other environmentally related taxes. A recent exception is the tax on single-use plastic bags. Introduced in 2018, it has proved effective in reducing use of such bags (Chapter 1). Collecting taxes on landfilling, as provided by the 2019 legislation on waste pricing, would help in moving up the waste hierarchy in a country where 80% of municipal waste is sent to landfill. In addition, the system of waste collection charges based on property size hinders progress towards separate collection and waste minimisation. Volume-based ("pay as you throw") charging systems, combined with extended infrastructure for separate collection of recyclable waste, could be instrumental in diverting waste from landfill.

Greece has other opportunities to expand the use of economic instruments. For example, taxes on fertiliser and pesticide use would help address diffuse pollution, which affects most water bodies. Such taxes have proved successful in other OECD countries (OECD, 2017). There is also room to better reflect financial, environmental and resource costs with water charges, as envisaged by the 2017 law on water pricing (EC, 2018b).

3.3.7. Distributional implications of environmentally related taxes

The economic crisis combined with an ineffective social protection system caused a surge in poverty. In recent years, Greece has embarked on a comprehensive reform of its social welfare system, introducing new benefit programmes and streamlining existing ones (EC, 2019a). In particular, a guaranteed minimum income programme (Social Solidarity Income [SSI]), introduced in 2017, provides basic income support to the poorest households. Greece also established a network of local community centres as one-stop shops where social assistance beneficiaries have access to various social services.

Reforming environmentally related taxes and subsidies requires assessing and minimising the potential impact of higher prices on vulnerable households. While Greece is a median OECD country in term of energy affordability risk,[7] nearly half of the most socially deprived households felt unable to keep their homes adequately warm in 2017, more than double the EU average (Flues and van Dender, 2017; Eurostat, 2019).

Since 2011, Greece has introduced measures to mitigate energy poverty: subsidies for heating oil (Section 3.3.3) and social tariffs for electricity up to certain consumption limits. In 2017, nearly 11% of households benefited from the Social Residential Tariff[8] (SRT), a share nearly triple that of 2011 (EC, 2019b). Yet less than half of SSI recipients benefitted from SRT in 2018,[9] suggesting scope for the SRT to better target the poorest (Marini et al., 2019). Greece developed an observatory to help identify energy-poor households and better target assistance (EC, 2019c). However, social tariffs distort prices and do not encourage people to reduce energy use. They also reduce investment capacity in key infrastructure. Providing direct support to vulnerable households, decoupled from energy consumption, would better address environmental and equity issues. Supporting renovation of the building stock through programmes such as Saving at Home (Section 3.4.2) and expanding gas central heating would also help alleviate energy poverty. Building age and heating type have been found to be influential factors in energy poverty levels (Ntaintasis, Mirasgedis and Tourkolias, 2019).

Social tariffs also apply on provision of water and waste services. For example, the water company of Attica, serving about 40% of the population, provides up to 2 m^3 per capita and per month free to SSI

beneficiaries. However, only 10% of SSI recipients in the country took advantage of social tariffs on water in 2018.

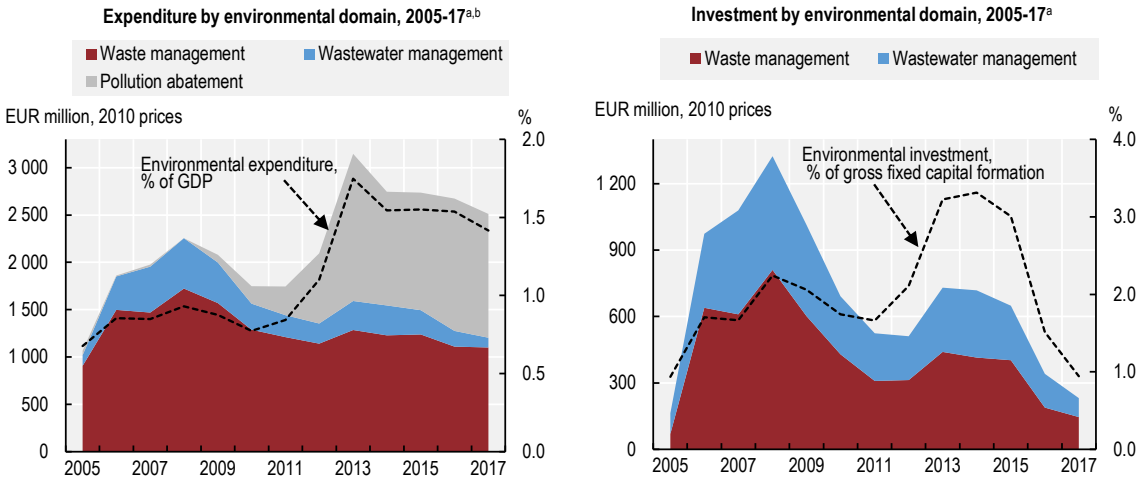
3.4. Investing in the environment to promote green growth

3.4.1. Public expenditure for environmental protection

According to national accounts, public environmental expenditure (current expenditure and investment) rose from 0.8% of GDP in 2010 to 1.7% in 2013, then decreased, reaching 1.3% in 2017 (Figure 3.7). Excluding pollution abatement, which is unusually high, public environmental expenditure accounted for 0.7% of GDP in 2017, in line with the EU average. Information on spending by the private sector is not available.

In a context of overall decline in investment, environmental protection has been particularly affected. Public investment in waste and wastewater decreased during the crisis, rebounded over 2013-15 with EU support and fell with the transition to the new EU programming period. Over the past decade, more than three-quarters of investment in environmental protection has been made by the central government.

Figure 3.7. Public investment in environmental protection has decreased



a) General government expenditure according to the Classification of the Functions of Government.
b) Pollution abatement seems to include public support to renewables, which is not in the definition of environmental protection.
Source: OECD (2019), *OECD National Accounts Statistics* (database).

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High public operational expenditure on waste management is not reflected in the performance of service provided by municipalities (Chapter 1). A system for benchmarking costs, as developed in France, would help improve waste service provision (OECD, 2016). Greece has planned to allocate a large proportion of EU funds to infrastructure for integrated waste treatment and source separation. It is actively promoting public-private partnerships in waste management, combining private capital and Cohesion Policy funding (European Parliament, 2017). However, investment in residual waste treatment, at the lower levels of the waste hierarchy, seems too high compared with investment in separate collection, sorting and recycling infrastructure (EC, 2019d). Care must be taken not to move from landfilling to poor quality mechanical and biological treatment installations.

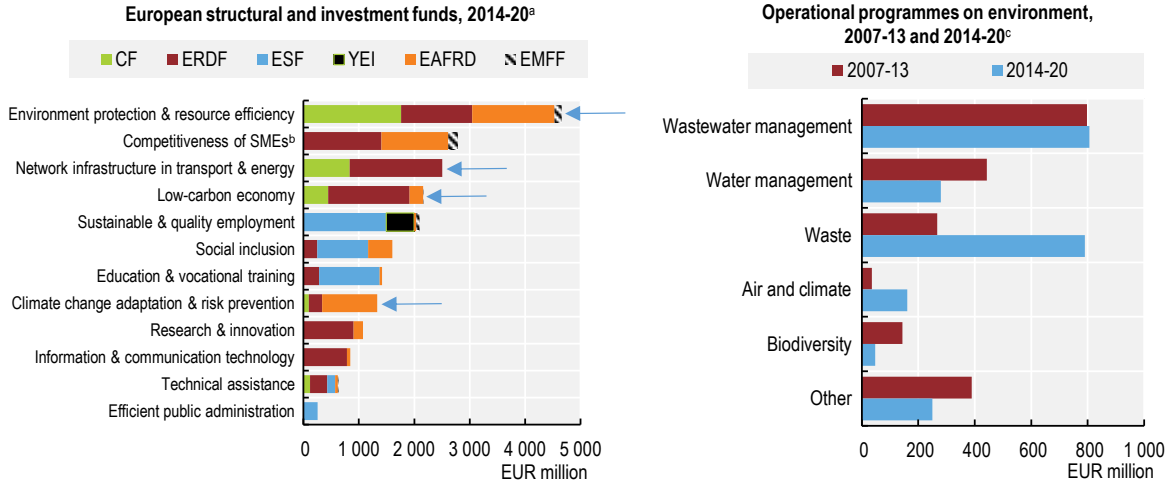
Despite progress in urban wastewater treatment, a significant share is still treated in individual sanitation systems (Chapter 1). Investment of around EUR 1.6 billion is needed to ensure that wastewater in

agglomerations is properly collected and treated (EC, 2019d). While nearly EUR 1.5 billion of EU funding is allocated to water and wastewater management over 2014-20,[10] project implementation has been slow. This is explained by delays in fulfilling conditions for funding: Greece did not pass a law providing for cost recovery in water services, or adopt the second generation of River Basin Management Plans, until 2017. The sustainability, quality and affordability of water provision suffers from lack of transparency, accountability and co-ordination among actors in the sector (EC, 2019e). In 2019, an information system was set up to monitor water companies' performance. The system will include information on cost recovery, infrastructure investment and planned human resources, drinking water quantity and quality, and water losses across the country.

European structural and investment funds

European funds are the main source of public investment in Greece (EC, 2019a). Over 2007-13, Greece was allocated EUR 15.9 billion in Cohesion Policy funding,[11] equivalent to 1% of annual GDP and 20% of government capital expenditure (EC, 2016). The EUR 20 billion support originally planned in the National Strategic Reference Framework 2007-13 was reduced by an amount corresponding to national public funding in the context of the economic adjustment programmes. This resulted in Greece being the first EU country to have fully absorbed the EU funds for 2007-13. Over the period, important shifts in funding occurred between and within policy areas. Within transport, funds were moved from rail and public transport to roads and from environment to enterprise support to help firms cope with the credit crunch. As a result, the largest share of funding went to transport (39%), three-quarters of it dedicated to roads. About 12% was spent on energy saving and clean urban transport. Only 13% was allocated to environment (compared to 17% planned), mainly for wastewater treatment and water supply (Figure 3.8). Implementation of major waste projects was hampered by problems with procurement procedures, a lack of public acceptance and limited municipal capacity to manage large tenders for technical investment (EC, 2016).

Figure 3.8. Effective use of EU funds is key to catching up on environmental infrastructure



a) EU structural and investment funds include the European Regional Development Fund (ERDF), Cohesion Fund (CF), European Social Fund (ESF), European Agricultural Fund for Rural Development (EAFRD), European Maritime and Fisheries Fund (EMFF) and Youth Employment Initiative (YEI).
b) Small and medium-sized enterprises.
c) The chart compares actual spending of the Operation Programme (OP) Environment and Sustainable Development 2007-13 (EUR 2.1 billion) with allocations for the environmental component (EUR 2.3 billion) under the OP Transport Infrastructure, Environment and Sustainable Development 2014-20, whose budget amounts to EUR 4.6 billion (excluding national contribution).
Source: EC (2016), *WP1: Synthesis Report, Ex post Evaluation of Cohesion Policy Programmes 2007-2013, Focusing on the European Regional Development Fund (ERDF) and the Cohesion Fund (CF), Task 3 Country Report Greece*; EC (2019), *European Structural and Investment Funds* (database).

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Over 2014-20, Greece is allocated EUR 21.4 billion in European structural and investment funds (ESIF)[12] to deal with the consequences of the financial and economic crisis and address development challenges (Figure 3.8). This represents annual averages of 1.7% of GDP and over 40% of public investment (EC, 2019a). Environmental protection and resource efficiency, the first priority, receives 22% in ESIF, including EUR 3 billion in Cohesion Policy funding, compared with EUR 2.7 billion over 2007-13, and EUR 1.6 billion in support to agriculture and fisheries. Including climate-related objectives (renewables, energy efficiency, sustainable transport, climate change adaptation and risk prevention), EUR 5.8 billion in Cohesion Policy funding was allocated to the environment.

The Operational Programme[13] Transport, Infrastructure, Environment and Sustainable Development (OP TIESD)[14] aims to comply with EU requirements (Figure 3.8). Although water remains the environmental priority, increased support is devoted to waste infrastructure to catch up with the backlog from 2007-13 and address major needs. Similarly, public transport accounts for most transport funding allocations (Section 3.4.3), reflecting the need to complete projects that had been delayed in the previous period, such as the Athens and Thessaloniki metros. However, implementation progress has been slow (EC, 2019f).

Greece has taken measures to improve its administrative capacity to manage ESIF, including setting up an electronic platform, introducing a simplified payment circuit, streamlining expropriation procedures and simplifying procedures related to archaeological work (EC, 2019a). However, project management is still hampered by inefficiency and capacity problems, notably for small municipalities, utilities and other local beneficiaries.

3.4.2. Investment in clean energy

Investment needs in renewables-based electricity and energy efficiency over the next decade are estimated at more than 2% of 2018 GDP annually (Table 3.2). This category makes up nearly half of funding needs in the energy sector to 2030.

Table 3.2. Investment needs in energy efficiency and renewables-based electricity are high

Investment in key areas of national energy planning

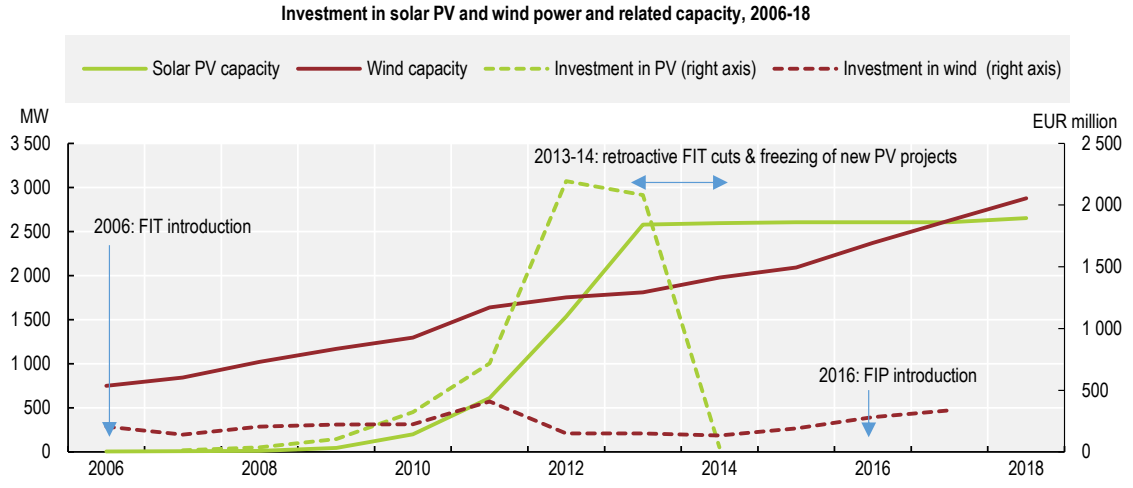
Sector	Total estimated investment over 2020-30 (EUR billion)
Energy efficiency	11.0
Electricity generation from renewables	9.0
Electricity system infrastructure	5.5
Circular economy-recycling	5.0
Projects for development of an electricity distribution network-digitisation	3.5
Cross-border natural gas pipelines	2.2
Natural gas networks and storage	2.0
Climate change-flood management-forests	2.0
New conventional electricity generation plants and upgrading of existing ones	1.3
Investment in the refinery sector	1.5
Research and innovation	0.8
TOTAL	43.8

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

Renewables

Most GHG emission reductions to 2030 are expected to come from development of electricity production from renewable energy sources (Chapter 4). Over the past decade, solar and wind power generation capacity has grown significantly (Figure 3.9). Investment has been supported by generous feed-in tariffs (FITs), decreasing technology costs and simplified licensing and permitting processes (Chapter 4). However, like some other OECD countries, Greece retroactively reduced, then stopped, its FIT programme,[15] thus halting investment in solar photovoltaics (PV). Although it was necessary to limit public support costs, such retroactive measures should be avoided to maintain investor confidence. In 2016, Greece introduced a feed-in premium (FIP) programme intended to gradually integrate renewables in the electricity market.

Figure 3.9. Changes in support programmes have stopped investment in solar PV



Source: IEA (2019), *Renewables Information* (database); HWEA (2018), "Investment opportunities in Greek wind power sector"; IRENA (2019), *Renewable Energy Statistics 2019*.

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Greece is among the OECD countries with the highest share of solar PV in electricity generation (29% vs. 10% on average). Integrating additional variable renewables while ensuring system reliability will require strengthening the internal transmission network, including interconnecting many islands with the main network, investing in flexible generation, enhancing regional interconnections, exploring the potential of energy storage and implementing demand-response programmes (IEA, 2017).

Energy efficiency

Energy efficiency measures in the residential and tertiary sectors are expected to have the largest mitigation impact in sectors not covered by the EU ETS by 2030 (Chapter 4). Buildings account for about 40% of total final energy consumption. Most were built before 1980 and lack insulation (IEA, 2017). Greece has been promoting energy efficiency in buildings through regulatory measures and financial support. The main programme, Saving at Home, mostly financed by EU funds, provided EUR 550 million in loans and grants to almost 52 000 households for energy saving investment over 2011-17 (EIB, 2019). For 2014-20, EUR 292 million (EU and national contribution) has been allocated to Saving at Home II, targeting low-income owners.

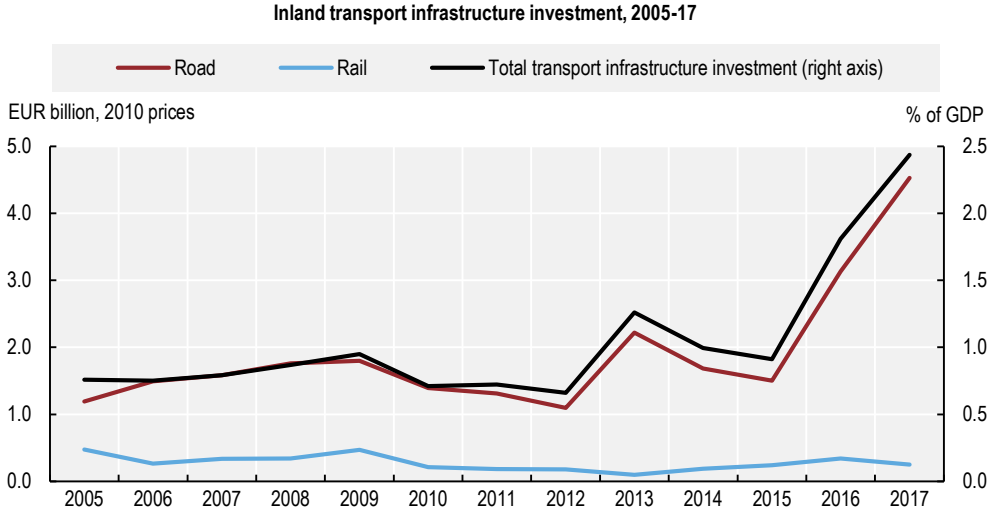
The 2018 long-term building renovation strategy aims to improve the energy performance of at least 7% of the current building stock by 2030 (MoEE, 2018). Investment needs are estimated at between

EUR 1.7 billion (moderate renovation) and EUR 2.1 billion (deep renovation). Beyond the use of EU funds, the strategy envisages developing private funding via energy service companies. Market immaturity, skills shortages, limited access to bank loans and low public awareness are barriers to investment.

3.4.3. Investment in low-carbon transport

Transport is the largest energy consumer and second highest greenhouse gas emitter due to the predominance of oil-based road transport (Chapter 1). Since 2015, investment in roads has surged (Figure 3.10). In 2017, it accounted for 2.3% of GDP, the largest share in the OECD. With support from EU structural and Cohesion Policy funding, Greece has doubled its motorway network over the past decade. Links between Athens and Thessaloniki, the port of Piraeus and Athens International Airport contribute to growth and competitiveness (EC, 2019a).

Figure 3.10. Transport investment has been mostly dedicated to road transport



Source: ITF (2019), "Transport infrastructure investment and maintenance", *ITF Transport Statistics* (database).

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Rail infrastructure quality lags that of most OECD countries (OECD, 2018a). Although rail investment has risen in recent years, it accounted for 0.1% of GDP in 2017, among the lowest rates in the OECD. The shares of rail in passenger and freight transport are among the lowest in the EU (EC, 2019g).

Out of the EUR 6 billion allocated to transport over 2014-20,[16] 48% is to be spent on public transport, 38% on road, 9% on rail and the remainder on ports and other elements (MED, 2019). In addition, the Connecting Europe Facility selected rail-focused Greek transport projects worth around EUR 0.9 billion over 2014-18. Major sustainable transport projects include extension of the urban public transport systems in Athens and the Attica region and construction of the metro in the Thessaloniki metropolitan area. Despite delays, Greece is moving these projects forward but the lack of sustainable urban mobility plans and weak development of soft transport modes result in continued reliance on cars (MIT, 2019).

A shift between road and rail investment has yet to materialise. The National Transport Plan 2019-37 projects that road will account for 61% of additional infrastructure cost and rail for 30%[17] (MIT, 2019). Over 2017-37, passenger rail transport is expected to double and rail freight transport to increase by 75%, albeit from very low levels. At the same time, road transport is projected to grow significantly, keeping its dominance in the modal split (92.7% in land passenger transport and 97.8% in freight transport by 2037).

3.5. Promoting eco-innovation and green markets

3.5.1. General innovation performance

Greece is a moderate innovator, ranking 20th among the 28 EU countries in 2018 (EC, 2019h). However, significant progress has been made in recent years. Research and development (R&D) spending increased from 0.7% of GDP in 2008 to 1.1% in 2017, chiefly due to higher contributions from the business sector. This trend puts Greece on track to reach the national target of 1.2% by 2020, but R&D intensity remains well below the OECD average of 2.4%. Although business R&D expenditure is rising, it is still lagging at 0.6% of GDP, compared with the 1.7% OECD average.

Framework conditions for innovation are not favourable, as R&D policies are fragmented and access to finance is limited (OECD, 2018; Amanatidou, Damvakeraki and Karvounaraki, 2018). Despite improved tertiary education attainment, the crisis led to significant brain drain. Advances in scientific excellence are hindered by the low intensity of public R&D, lack of a performance-based funding system and weak science-business links (EC, 2019a). Investment is needed to boost the low level of technological development, reflected in the very low number of patents. The small size of Greek companies limits their capacity to develop and commercialise innovations.

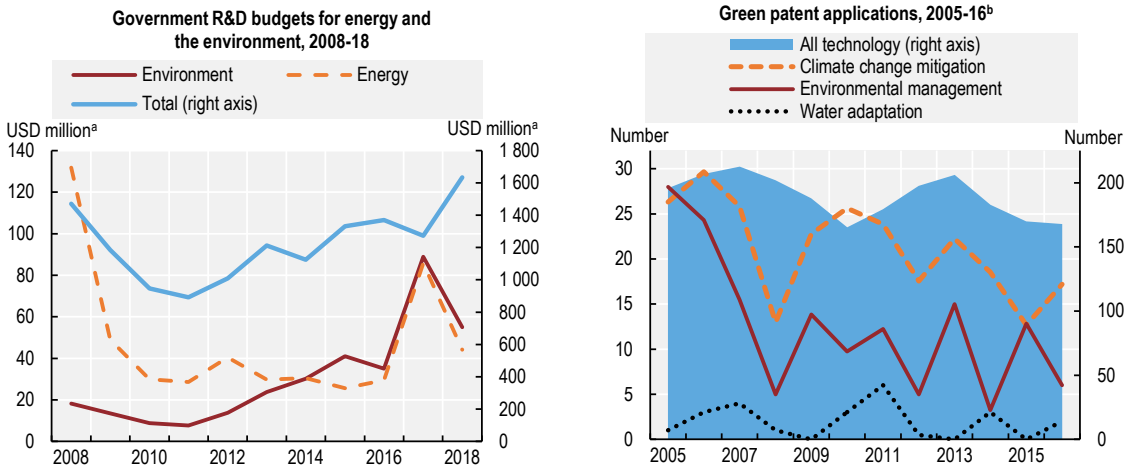
The National Research and Innovation Strategy for Smart Specialisation 2014-20 (RIS3) aims to promote links between research and industry and accelerate dissemination of innovation. National and regional RIS strategies identified key growth sectors, including agro-food, tourism, health, information and communication technology, energy, environment and sustainable development, and transport and logistics. However, regional administrations lack the capacity and innovation policy experience, and co-ordination with the national RIS strategy has not been adequate (EC, 2019i). Implementation across regions is uneven and slow. Strengthening bottom-up participatory approaches (via the entrepreneurial discovery process) will help focus investment on Greece's strengths and long-term needs over the next RIS programming period (2021-27).

3.5.2. Performance in eco-innovation

Environment-related R&D, technology and innovation

Greece's eco-innovation performance is modest, placing it in the bottom third of EU countries in 2017 (EC, 2019j). The government R&D budget on environment has increased since 2012, though the trend for energy is unclear. As EU funds are the main source of R&D funding, EU programming cycles may explain variation in trends (Figure 3.11). From 2017 to 2018, the shares of environment and energy in the government R&D budget fell by more than half to 3% each – above the OECD average for environment (2%) but well under that for energy (5%). While an information system is in place for public funded R&D projects, there is no inventory of private energy R&D spending or beneficiaries and outcomes (IEA, 2017). Such an inventory would be useful in assessing the technology outlook for long-term energy sector development. In a context of limited green patent applications, those related to climate change mitigation (mostly energy generation, transmission and distribution) have been declining.

Figure 3.11. The public environmental R&D budget has grown but green patent applications are declining



a) At 2010 prices and purchasing power parities.
b) Patent statistics are taken from the Worldwide Patent Statistical Database of the European Patent Office, with algorithms developed by the OECD. Data refer to patent applications filed in the inventor's country of residence according to the priority date and apply solely to inventions of high potential commercial value for which protection has been sought in at least two jurisdictions.
Source: OECD (2019), "Research and Development Statistics: Government budget appropriations or outlays for RD"; *OECD Science, Technology and R&D Statistics* (database); OECD (2019), "Patents", *OECD Environment Statistics* (database).

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Despite the lack of a coherent approach on eco-innovation, some funding programmes have supported innovation in environment-related areas. Climate change, assessment of ecosystems and natural capital, environmental technology, sustainable energy and transport were among the priorities of the Strategic Plan for the Development of Research, Technology and Innovation under the National Strategic Reference Framework 2007-13. EUR 1.3 billion in EU Cohesion Policy funding was spent on research and innovation over this period, although the environment-related share is unclear.

Issues related to environment (waste management; prevention, protection and restoration of air, soil, groundwater and marine environment; climate change; standard systems of monitoring and measuring environmental impact), energy (promoting renewables, energy efficiency in buildings, smart grids) and transport remain among the eight priorities[18] of the 2015 National Research and Innovation Strategy for Smart Specialisation 2014-2020, which were allocated EUR 1.1 billion in ESIF. The 2018 National Circular Economy Strategy aims to use these funds to develop research on the environmental footprint of the agro-food sector and life-cycle analysis of products. The strategy highlights eco-innovation as a main pillar.

Research institutions, innovative firms and individual researchers have benefited from EUR 0.8 billion in funding from the EU Horizon 2020 programme (EC, 2019a). The programme supported a pioneer hybrid system with renewables and energy storage technology allowing Tilos island to become fossil fuel free. It also helped develop an innovative biological nitrogen and phosphorus removal system for wastewater, a SMART-Plant project for which the Athens Water Supply and Sewerage Company won an environmental award.

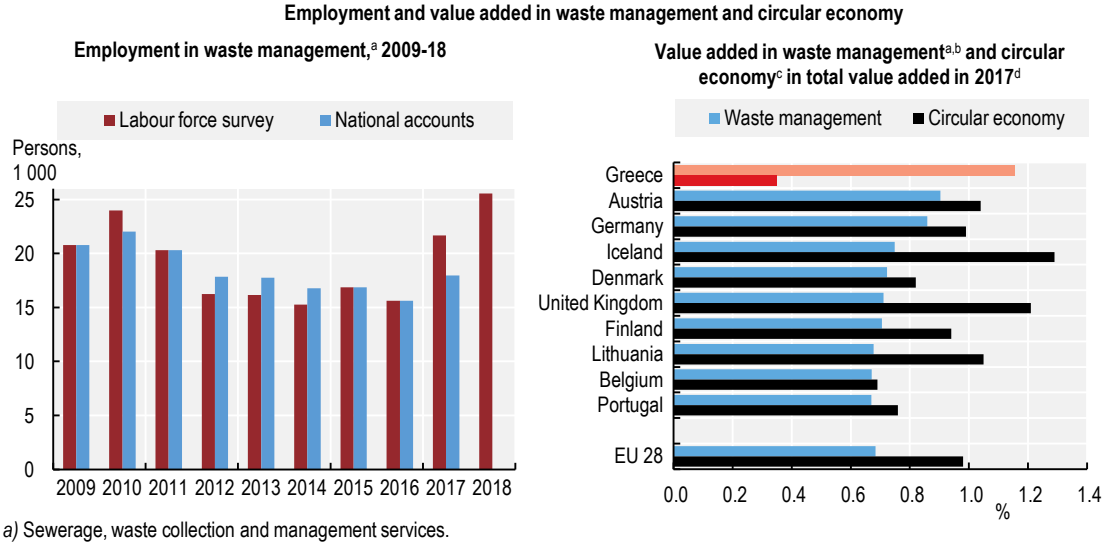
Eco-innovation faces the same challenges as general innovation: fragmented R&D policies, limited research activity, weak business participation and limited co-operation between academia and business (MoEE, 2019; EC, 2018c). As in most other OECD countries, the eco-innovation policy mix is geared towards supply-side measures, mainly financial R&D support but also networks and partnerships (e.g. clusters on nano/microelectronics and embedded systems and on space technology). Demand-side instruments, including regulations, standards and certification, are undermined by weak enforcement of

environmental policies (Chapter 2). The use of price and tax instruments is limited or inconsistent and uptake of green public procurement is low.

Expanding environment-related markets and employment

There is insufficient information on the environmental goods and services sector. The 2015 National Waste Management Plan quoted an EU report suggesting that 16 000 jobs could be created in the waste sector but progress is not being tracked (EC, 2017b). Employment in waste management seems to be showing a rising trend, although the growth rate varies by data source (Figure 3.12). Additional effort is needed to monitor the transition to a circular economy, for example via the EU Circular Economy Monitoring Framework. While waste management accounts for a high share of total value added, the sectors of waste recycling, repair and reuse and rental and leasing are underdeveloped compared with other EU countries.

Figure 3.12. Employment in waste management is growing but value added in circular economy is low



a) Sewerage, waste collection and management services.
b) The figure shows the 10 OECD countries with the highest percentage.
c) Recycling sector, repair and reuse sector and rental and leasing sector.
d) Waste management: 2017 or latest available year. Circular economy: 2016.
Source: ELSTAT (2019), *Labour Force Survey* (database); OECD (2019), *OECD National Accounts Statistics* (database); Eurostat (2019), *Circular Economy Monitoring Framework* (database).

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The 2019 Energy and Climate Plan estimates that measures to promote renewables and improve energy efficiency in buildings will increase domestic value added by EUR 12.6 billion and EUR 8.1 billion, respectively, by 2030 (MoEE, 2019). More than 37 000 full-time jobs are expected to be created in renewables and 22 000 in energy efficiency. By comparison, there were 25 000 direct and indirect jobs in renewables in 2017, twice the upper-bound estimate of direct and indirect coal-related jobs[19] (EurObserv'ER, 2018; Alves Dias et al., 2018). National statistics need to be improved to monitor employment trends and support reallocation of labour from shrinking to growing activities. The Austrian and French governments, for example, regularly monitor skills and forecast requirements for the transition to a low-carbon economy (OECD, 2015), then use this information to inform education and training policy.

Recommendations on green growth

Framework for sustainable development and green growth

- Adopt the national SDG implementation plan and ensure coherence with the revised Growth Strategy and its future updates.
- Further develop environmental accounts (environmental protection expenditure, environmental goods and services sector, material flow and natural capital accounts) and promote their use in policy making.

Greening the system of taxes, charges and prices

- Review tax variation across fuels and uses to provide a consistent carbon price signal. Gradually close the gap between diesel and petrol taxes.
- Establish an institutional mechanism to assess the environmental effects of fiscal instruments, identify subsidies with adverse environmental effects and prioritise which to phase out.
- Harmonise the taxation of new and old vehicles. Vary the circulation tax by air emission standards in addition to CO_2 until road tolls are linked to vehicle emissions. Enforce access restrictions for the most polluting vehicles in metropolitan areas.
- Continue to improve information on energy poverty to better target assistance and assess the cost-effectiveness and environmental impact of such assistance. Consider replacing social energy and water tariffs with direct payments (not linked to energy or water use) as part of the Social Solidarity Income.

Investing in the environment to promote green growth

- Ensure effective use of EU funding for environment-related infrastructure by strengthening beneficiaries' administrative capacity for management of the funds, improving project planning and co-ordination, reinforcing public procurement procedures and supporting municipalities in implementing investment plans.
- Improve the accountability and co-ordination of actors in the water sector. Further assess utilities' performance to ensure that water prices cover the cost of service provision and reflect environmental and resource costs.
- Align waste investment with circular economy objectives. Establish a system to assess municipalities' performance in providing waste services.
- Rebalance investment from road to rail. Implement sustainable urban mobility plans and develop soft transport modes.

Promoting eco-innovation and environment-related markets

- Strengthen energy research and promote eco-innovative technological solutions in the framework of Smart Specialisation Strategies. Focus investment on the R&D activities with the highest social return.

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Notes

[1] EUR 257 billion from European partners and EUR 32 billion from the International Monetary Fund.

[2] The VAT gap is the difference between the amount collected and the theoretical net total VAT liability for the economy under the current VAT system.

[3] The total amount of tax overdue for payment at the end of the fiscal year.

[4] Effective tax rates on energy use translate excise and carbon tax rates into rates per tonne of CO_2.

[5] The tax does not apply on hybrids up to 1 549 cubic centimetres registered by 31 October 2010. For hybrids with higher engine capacity registered by that date, the tax is reduced by 60%.

[6] A presumption about an individual's annual personal income is made, depending on their possessions (including house, car, boat) in the year they are being taxed for, on the basis of the expenses the possessions imply. Regarding cars, the presumed income is calculated according to engine size. If the individual's declared income is lower than the calculated presumed income based on their possessions, their personal income tax for the year is calculated on the higher amount.

[7] 8% of households spend more than 10% of disposable income on heating fuel and electricity and are below the poverty line after expenditure on energy.

[8] In addition, in 2015-16, 300 kWh per month was provided free of charge to residential customers facing severe poverty.

[9] This is likely due to the cost of the non-refundable deposit required for electricity meters.

[10] Under the various operational programmes.

[11] From the Cohesion Fund and European Regional Development Fund, after decommitment and correction.

[12] Including the national contribution, the total budget amounts to EUR 26.8 billion. In addition, Greece received EUR 2.7 billion from the European Fund for Strategic Investments, EUR 627 million from the EU's Connecting Europe Facility funding instrument and EUR 781 million from the Horizon 2020 programme.

[13] Greece adopted 20 programmes setting priorities for funding over 2014-20: Competitiveness, Entrepreneurship and Innovation; Transport Infrastructure, Environment and Sustainable Development; Human Resources Development, Education and Lifelong Learning; Reform of the Public Sector; Rural Development; Fisheries; Technical Assistance; and 13 regional programmes.

[14] The operational programme budget amounts to EUR 4.6 billion (excluding national contribution). Environment and transport each account for half the budget.

[15] Fixed price support continues to be offered to small-scale and demonstration projects and non-interconnected islands.

[16] EU structural and investment funds and national contribution under OP TIESD and regional operational programmes.

[17] The cost of the preferred scenario is estimated at EUR 7.5 billion in addition to the EUR 7 billion secured investment in the reference scenario.

[18] Agro-food; life sciences and health-pharma; information and communication technology; energy; environment and sustainable development; transport and logistics; materials and construction; culture, tourism, cultural and creative industries.

[19] 6 500 jobs in coal mining and power plants and 6 000 jobs dependent on coal activities throughout the coal value chain, taking intra- and inter-regional trade into account.

Part II Progress towards selected environmental objectives

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

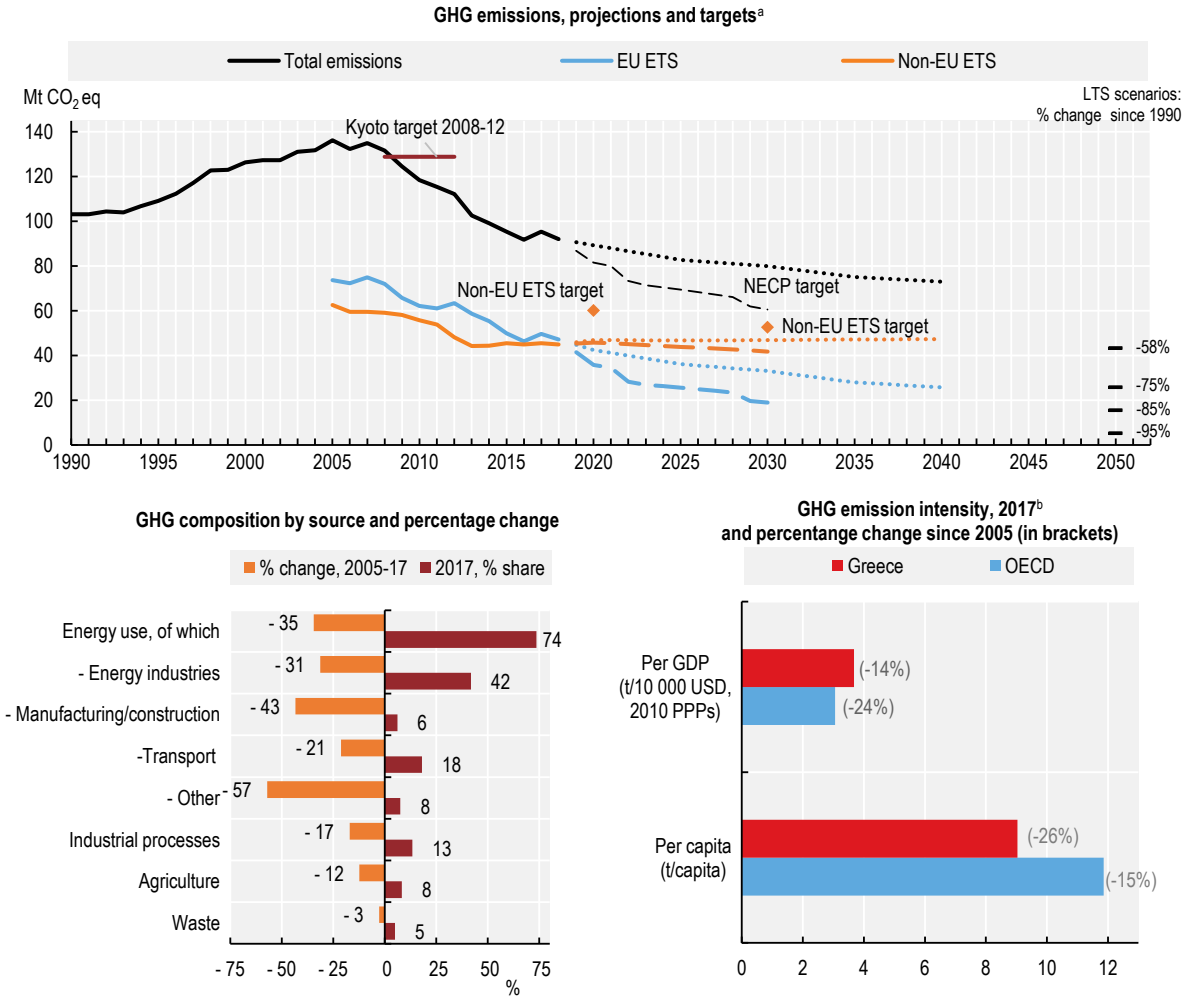
4.2.1. Emission profile

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

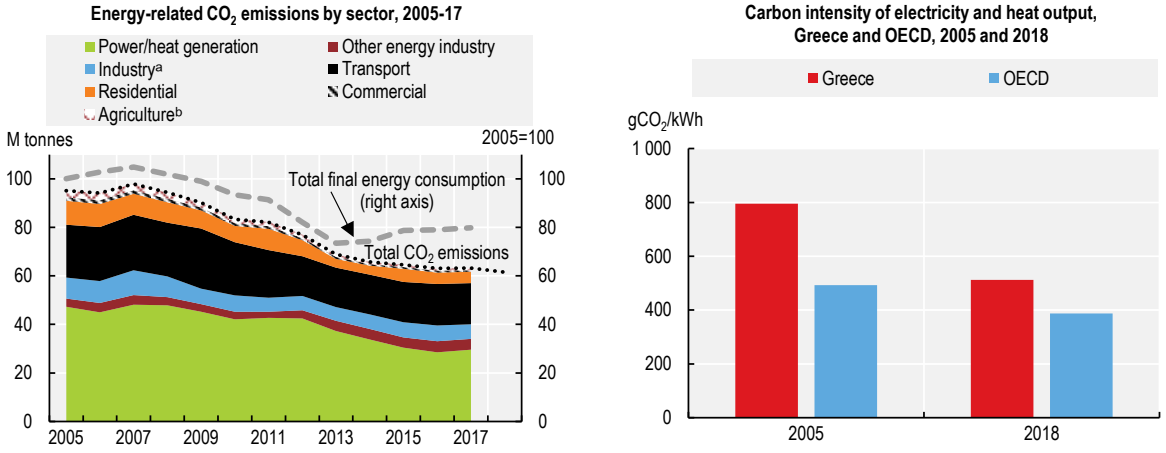
4.4.1. Reducing GHG emissions in the energy sector

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%)

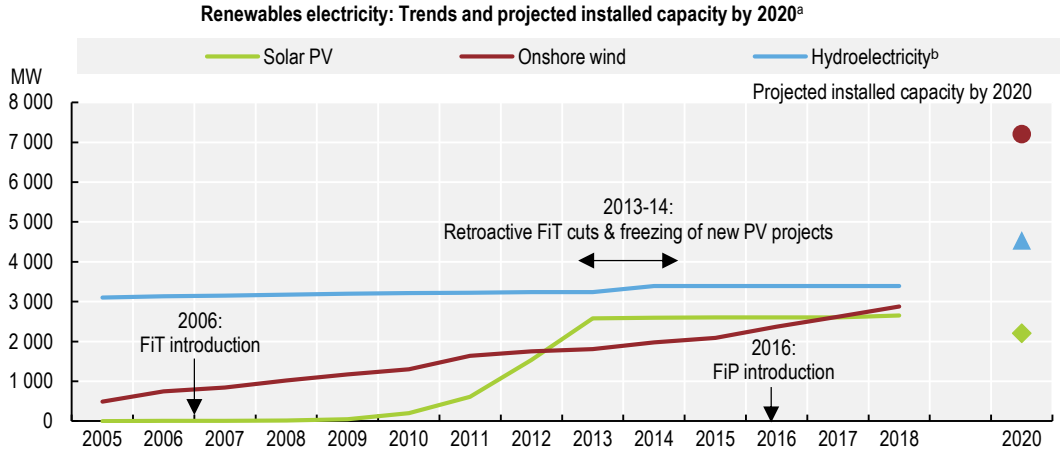
Note: The 2010 NREAP aims to reach a 20% share of renewables in gross final energy consumption by 2020, above the objective of 18% imposed by the EU directive (2009/28/EC). 2030: targets set in the final version of the NECP (in brackets are those of the first version for comparison).
Source: Eurostat (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



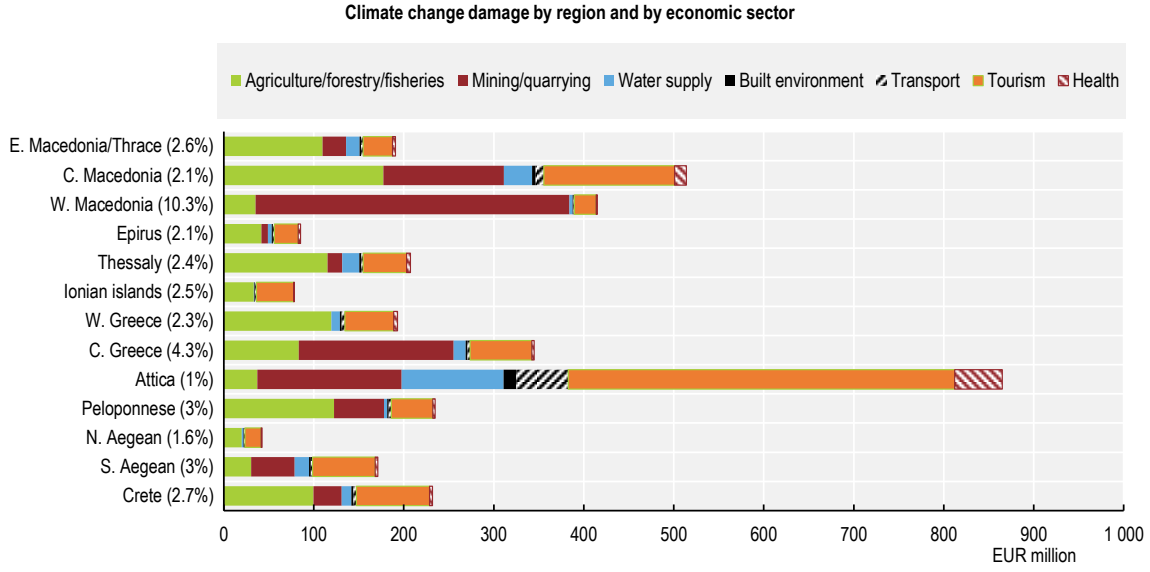
Note: Forest fire data are based on MODIS satellite imagery at 250 m ground spatial resolution. Data refer to total burned areas larger than 40 ha (approximately 75-80% of total area burned).
Source: CRED (2019), *Emergency Events EM-DAT* (database); EU (2019), *Copernicus Emergency Management System* (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.

5 Conservation and sustainable use of biodiversity

Greece's forests, mountains, wetlands, marine and coastal zones and agricultural areas are rich in biodiversity and provide a home to numerous species of local and international importance. The national policy framework for biodiversity has been updated in recent years. Still, a notable number of species are in an unfavourable state and biodiversity considerations are not sufficiently integrated into sectoral policies. This chapter reviews pressures influencing the status and trends of biodiversity; the legal, strategic and institutional framework; policy instruments and financing tools established to promote the conservation and sustainable use of biodiversity; and the degree to which biodiversity considerations have been mainstreamed into sectoral policies.

5.1. Introduction

Greece is situated in southeastern Europe at a crossroads between Europe, Asia and Africa. It is one of the most biodiverse countries in Europe due to its high species diversity, extensive coverage of natural areas, lengthy coastline and thousands of islands, which create diverse landscapes with high aesthetic and cultural value. This topographical diversity contributes to the great biological wealth of the country, which is home to abundant flora and fauna, including many endemic plant and animal species, and a wide variety of ecosystems (MoEE, 2016).

Since the last Environmental Performance Review (EPR), Greece has made notable progress in biodiversity conservation and sustainable use. The legal framework was strengthened with laws on biodiversity conservation (2011) and management bodies of protected areas (2018). The National Biodiversity Strategy and related action plan (2014) provide a comprehensive framework with detailed sub-targets to improve knowledge and the status of biodiversity and mainstream it into sectoral policies. In 2017, the Natura 2000 network was expanded in order to address gaps in protected marine habitats and species, especially with regard to marine areas, albeit from a low base. As a result, habitat conservation status has improved in recent years.

However, effective administration and functioning of protected areas is hampered by lack of management plans, which cover a very small share of the network. Additional obstacles are lack of capacity and awareness among authorities and the public.

More thorough integration of biodiversity concerns into spatial planning could be achieved by improving the quality of strategic assessment. Illegal construction, particularly in coastal zones and forest areas, is harmful to biodiversity and ultimately hampers habitat and species protection.

5.2. State, pressures and trends

5.2.1. State and trends in biodiversity

Greece belongs to the Mediterranean zone of the Palaearctic biogeographical region. The territory of Greece occupies around 132 000 km^2, more than half of which consists of natural and semi-natural areas. Agricultural areas represent 48% of the land area, almost evenly shared between arable land and permanent crops and permanent pasture; forest covers 32% and inland waters, including wetlands, represent 2% of the territory. The remainder is made up of built-up areas and other land (Basic statistics). Box 5.1describes the main ecosystem types and pressures.

The country has distinct topographical diversity, with 9 800 islands, diverse landscapes and numerous rivers, streams, gorges, valleys and peninsulas. It is primarily mountainous, with two-thirds of land being covered by medium-height mountains. Its extensive coastline totals some 18 400 km and the many islands are located between the Aegean and Ionian seas (MoEE, 2016). Parts of Greece belong to the Mediterranean Basin Hotspot, the world's second largest.

Box 5.1. Major ecosystem types in Greece and related pressures

Forests

Protected forest animals include bear, wolf, jackal, bobcat, chamois, deer, viper and Greek tortoise. Southern and central Greece and Crete, in particular, are home to several key biodiversity areas. A large share of forest and other wooded land is included in the areas of high nature value, which were identified to implement certain measures under the Rural Development Programme (RDP). Coastal forests and forests at low altitudes have experienced degradation due to increased urbanisation and conversion into agricultural land.

Mountains

Mountainous ecosystems extend from the Rhodope range to the higher mountains of Crete, and almost all are included in the Natura 2000 network. Mountainous regions host a wealth of species and ecosystems and create conditions for isolation and endemism. Beyond forest edges, the area is covered by shrub and herbaceous vegetation that has been degraded by overgrazing, which has been reported as a serious threat in southern Europe. In recent years, further pressures have come from tourism.

Agricultural areas

The high diversity of agricultural ecosystems in Greece includes terraced landscapes (Aegean islands), traditional olive groves (Amfissa, Corfu, Mytilene, etc.), vineyards (Santorini) and pastures. These are home to almost all wild fauna and flora in agricultural ecosystems and as such deserve special protection. A high share of agricultural land (68%) is categorised as high nature value. Pressures on biodiversity come from expansion of intensive farming, abandonment of traditional extensive mountain agriculture and livestock farming, and increased monocultures.

Wetlands

Greek wetlands include deltas, marshes, lakes, lagoons, springs, estuaries, rivers and reservoirs. The latest inventory counts 411 wetlands, mostly in the north and the islands. Ten have been designated as wetlands of international importance under the Ramsar Convention. In addition, lagoons are considered priority habitats of European interest. Wetlands have poor conservation status. Pressures arise from human activities, especially drainage and both point source and diffuse pollution.

Coastal and marine areas

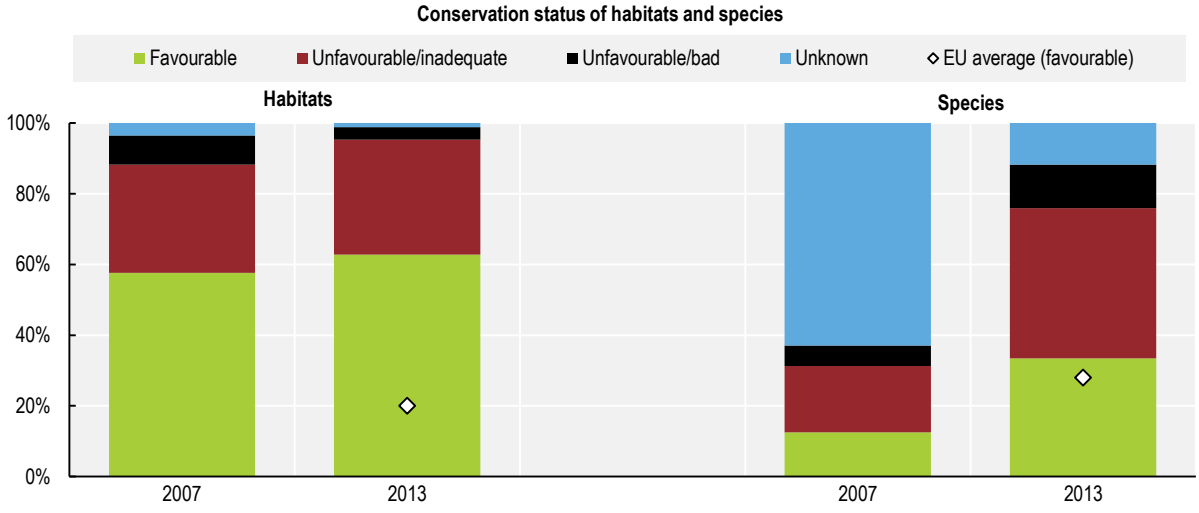
Coastal and marine ecosystems have high biological, aesthetic, cultural and economic value. Over half the coastline runs along the many islands. The main species found in coastal and marine areas are marine macroalgae, coastal land flora, cetaceans, monk seals, sea turtles and several hundred fish species. The main natural pressures arise from extreme climate change, especially sea level rise, changes in storm frequency and intensity, erosion and flooding. Pressures from human activities in coastal ecosystems include tourism, population increase and overexploitation of natural resources.

Source: MoEE (2016).

Natural habitats

The conservation status of habitats has improved in recent years and is generally positive. The latest report (2013) on habitat conservation status under the Habitats Directive (92/43/EEC) classifies a majority (63%) as favourable, around one-third (33%) as unfavourable/inadequate and a small fraction (3%) as unfavourable/bad. Compared to EU averages, Greece scored significantly more positively on all indicators (Figure 5.1). Unofficial data for the new reporting period does not show important changes from the 2013 assessment.

Figure 5.1. The conservation status of habitats and species has improved



Source: EEA (2019), *Habitats of European Interest* (database); Eionet (2019), *Reporting under Article 17 of the Habitats Directive*.

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Coastal habitats represent about 16% of habitat types of EU importance (i.e. 14 out of 85 types). Wetlands, river mouths and underwater Posidonia meadows are home to many species, but almost all coastal habitats are in unfavourable condition.

The reasons lie in increasing urbanisation, tourism development and extension of transport networks since the 1990s. The concentration of population and increase in human activities in sensitive areas result in overexploitation of natural resources, along with decision-making failures, including poor implementation and co-ordination among state authorities.

Drainage and conversion of coastal wetlands are mainly driven by expansion of agricultural areas and housing, entailing overpumping and clearing of natural vegetation. These changes have resulted in the loss of important ecosystem services provided by wetlands, such as cleaning of air, water and soil (MoEE, 2016).

Flora and fauna

With more than half of species (55%) of European interest having unfavourable status (Figure 5.1), more needs to be done to address the root causes. This is particularly pressing given the country's importance to European and Mediterranean flora and fauna, as confirmed by the large number of habitat types and species of European interest.

The unfavourable status of species can be attributed to a number of factors. Landscape modification and habitat fragmentation negatively affect all taxonomic groups, including birds, mammals, reptiles, amphibians and invertebrates, especially mobile and migratory species. Many of these species' habitats and ecological corridors occur outside protected areas and thus have less protection. In addition, illegal

hunting and the use of poisonous bait affect mostly species rather than habitats. Finally, animals respond much more quickly than habitats to environmental threats.

There is high endemism in Greece and many endemic species have a limited spread (e.g. a single island). Greek flora includes 5 752 species, 22% of them endemic. Around 23 000 animal species have been recorded in terrestrial ecosystems, 17% of them endemic, while marine environments are home to around 3 500 animal species. Specific efforts should be made to protect endemic species and their habitats.

The 2009 national red list covered 300 threatened plant species and subspecies, 422 vertebrate animals and 591 invertebrates. Some 16% of species are considered endangered. In particular, one-third of freshwater fish and about one-fourth of mammal and amphibian species are threatened. Greece should consider updating the list.

A notable example of endangered species in Greece is Caretta caretta, the loggerhead sea turtle, in the Mediterranean. It nests in Kyparissia Bay in the western Peloponnese, an area threatened by unregulated infrastructure development. The European Commission has begun an infringement procedure against Greece for failure to provide adequate protection for the endangered sea turtles.

Birds are less threatened than other taxa and initiatives have been taken to protect selected species, like the Dalmatian pelican (BirdLife International, 2015). Still, common birds in Greece declined by almost 20% over 2007-16, a trend similar to that in the rest of Europe. Trends diverged from European ones for farmland birds (down 2.6%) and forest birds, which are showing a steep (38.15%) decline. Greece should support conservation measures directed to birds in all sensitive areas and continue monitoring the evolution of bird indicators (NCESD, 2018). Collaboration between researchers and policy makers can help develop measures for protection of bird species in areas identified for wind farm development.

5.2.2. Pressures on biodiversity

The main causes of biodiversity loss in Greece are related to natural system modifications, including urbanisation and habitat fragmentation, pollution, invasive alien species, climate change and fires. Key pressures behind these are intensive land use and policies related to agriculture, fisheries, transport and tourism, especially coastal (Section 5.7).

Habitat fragmentation

Although Greece's artificial land coverage remains below the EU average, over time the country has registered a shift from pastures and agricultural land to urban areas, which has caused loss, degradation and fragmentation of habitats. Greece is one of the least fragmented countries in the European Union (EU). Despite a slowdown between 2012 and 2018, natural areas continue to be transformed into artificial ones by infrastructure and residential development, sometimes carried out without proper planning.

The road network in Greece is extensive, exacerbating landscape fragmentation. Only 24% of the terrestrial surface was found to be more than 1 km from the closest road, far below the European average in 2013 (42%). Moreover, most areas with no roads (44%) cover only up to 1 km^2 (NCESD, 2018).

Road construction harms biodiversity by giving people access to natural areas for poaching and illegal logging, causes soil erosion and indirectly pollutes watercourses, increases the mortality rate of mammals and reptiles, and reduces habitats for protected species.

Climate change

As in other countries, temperature increases may affect species' ability to survive and reproduce. The Mediterranean basin is one of the regions most vulnerable to climate change, which will affect ecosystems' capacity to provide goods and services. Decreased water availability for drinking and irrigation will contribute to increasing erosion and loss of agricultural potential, and increase the cost of managing such problems (Birdlife International, 2017).

For Greece, the main effects are related to changes in flowering patterns and distribution and the migration and reproduction patterns of various species. In addition, it is estimated that 30% of soil in sensitive climate

zones has been subjected to various stages of desertification, and the percentage is expected to grow (Chapter 4) (MoEE, 2016).

Soil, water and air pollution

Atmospheric pollution is another pressure on biodiversity, causing habitat degradation. Greece has high concentrations of ground level ozone, which, beyond human health, affects vegetation, forests and crops. Key drivers are industrialisation, intensive agriculture, waste disposal, marine accidents and extensive use of non-renewable energy sources (Chapter 1) (MoEE, 2016).

Invasive alien species

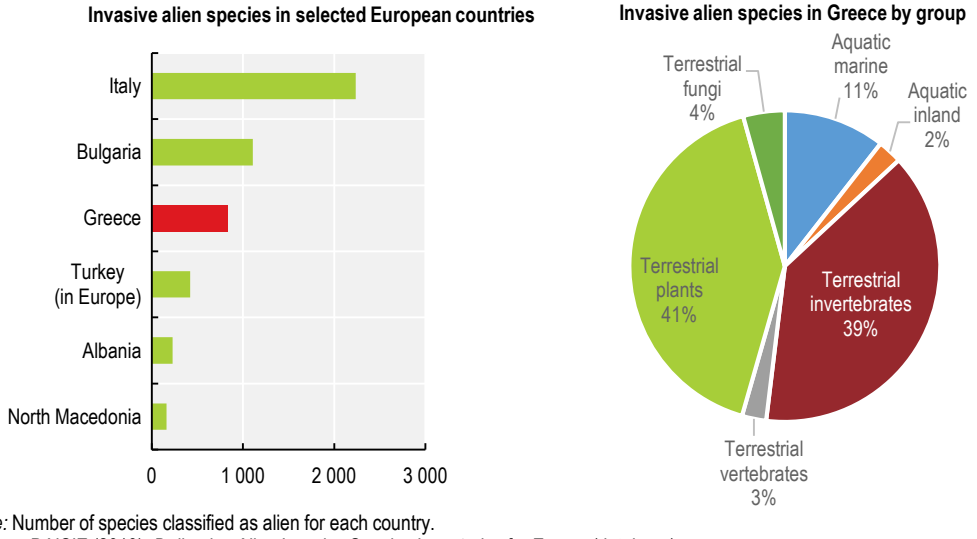
Invasive alien species are those that become established in areas outside their natural range, competing with native species for similar resources and sometimes interbreeding with them. They can also cause significant economic damage. Greece appears to have fewer invasive alien species than some neighbouring countries, though this could indicate data and monitoring gaps (EC, 2019b). Most invasive alien species in Greece are terrestrial plants and invertebrates (Figure 5.2).

Centres and organisations working on invasive alien species in Greece include the Hellenic Centre for Marine Research, which researches marine invasive alien species of flora and fauna, and the Hellenic Network on Aquatic Invasive Species, which contributes to European reporting. As regards terrestrial invasive alien species, the Delivering Alien Invasive Species Inventories for Europe (DAISIE) project helped fill important knowledge gaps, especially concerning flora (MoEE, 2016).

The EU biodiversity strategy requires that by 2020, invasive alien species are identified, priority species controlled or eradicated and pathways managed to prevent new invasive species from disrupting European biodiversity. This is supported by a regulation on invasive alien species (1143/2014). In 2019, the European Commission called on Greece to step up its efforts in implementing the regulation.

The MoEE has plans to improve monitoring of invasive alien species and develop management plans to tackle them. The EU has urged Greece to investigate the apparent lack of data and seek ways of promoting better monitoring. Greece should take effective measures to eradicate invasive species as early as possible, to avoid long-term management costs (EC, 2019b).

Figure 5.2. Greece reports fewer invasive alien species than some neighbouring countries



Note: Number of species classified as alien for each country.
Source: DAISIE (2019), *Delivering Alien Invasive Species Inventories for Europe* (database).

StatLink https://doi.org/10.1787/888934155953

Fires

Fires affect the biodiversity of a region by endangering species, changing drainage basins' hydrological and geomorphological features and increasing soil erosion. In particular, animal species that lack good escape mechanisms are affected beyond recovery, which can result in extinction of local populations. In addition, even temporary loss of forest vegetation can negatively affect fauna (MoEE, 2016).

The area affected by forest fires in the summer of 2018 was smaller than in previous years, accounting for about half the average area affected over 2010-17. Fires in 2018 were nevertheless among the deadliest worldwide in terms of human casualties. In all, 34 fires (above 30 ha) on 12 066 ha were mapped, including 2 331 ha in Natura 2000 sites (San-Miguel-Ayanz et al., 2019). Climate change is expected to exacerbate the occurrence of wildfires.

Natural regeneration is expected in many areas with Mediterranean pine forests. For other areas, Greece has planned restoration measures. For example, a LIFE programme on Mount Parnonas in the Peloponnese, an EU priority habitat in which black pine grows, takes biodiversity concerns into consideration (MoEE, 2016).

5.3. Legal and institutional framework

5.3.1. Legal and strategic framework

Greece has a comprehensive legislative framework to support biodiversity, with legislation covering biodiversity, forestry and other areas (Table 5.1). Strong emphasis is put on the establishment and legal protection of protected areas. The most important recent laws are those of 2018 establishing management bodies for protected areas and of 2011 on biodiversity conservation.

Table 5.1. Main biodiversity-related laws

Number	Year	Aim
Law 4519	2018	Establishment of management bodies for protected areas
Law 4282	2014	Development of aquaculture
Law 3937	2011	Biodiversity conservation (framework law)
Law 2637	1998	Protection of wildlife sanctuaries
PD 434/30	1995	Conservation and protection of indigenous livestock breeds and habitats or landscapes (decree)
Law 2204	1994	Ratification of Convention on Biological Diversity
LD 996	1971	Protection of national forests, aesthetic forests and conservation of monuments of nature (decree)
Law 1469	1950	Protection of historical sites and places of special beauty

Source: Government of Greece (2019), *Country submission*.

Greece is party to all the main biodiversity-related international conventions, including the Convention on Biological Diversity (CBD), the Convention to Combat Desertification, the Convention on International Trade in Endangered Species (CITES; Box 5.2), the Bern Convention on the Conservation of European Wildlife and Natural Habitats, the Bonn Convention on the Conservation of Migratory Species of Wild Animals, the Ramsar Convention on Wetlands of International Importance and the Framework Convention on Climate Change. It is also party to the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean but has not yet ratified the protocols on Specially Protected Areas and Biological Diversity and on Integrated Coastal Zone Management.

Box 5.2. Efforts to tackle environmental crime

Various initiatives are in place to address environmental crime, including a risk assessment on illegal trafficking in endangered species. Customs authorities play a key role, as demonstrated by a 2017 joint operation with Spanish authorities, supported by Europol and Eurojust, to prevent illegal export of eels.

As an EU member, Greece is implementing the EU Timber Regulation (995/2010), which aims to reduce illegal logging by ensuring that no illegal timber or derived product can be traded in the EU.

It is also implementing the EU Action Plan for Forest Law Enforcement, Governance and Trade (FLEGT), which requires all timber and timber products imported into the EU from partner countries to be covered by a FLEGT licence stating that the products were legally produced.

Source: Government of Greece (2019).

In line with CBD commitments, in 2014 Greece adopted the National Biodiversity Strategy and Action Plan (NBSAP) for 2014-29 (MoEE, 2014). The 2009 EPR also recommended this. The strategy is based on three pillars: halting biodiversity loss, promoting biodiversity as a national natural capital and intensifying Greece's contribution to prevention of global biodiversity loss. There are 13 main targets, split into non-quantitative sub-targets, with relevant indicators (Table 5.2). The coming development of a new action plan beyond 2019 offers an opportunity to assess achievements and remaining challenges. The new action plan should take into account the key focus areas of the CBD post-2020 global biodiversity framework.

Greece has conducted a voluntary review of implementation of Sustainable Development Goals (SDGs) (Chapter 3). Regarding the SDG 14 commitment on life below water, and in accordance with the EU Marine Strategy Framework Directive, in 2018 Greece endorsed a framework of measures covering all aspects of marine pollution and degradation. It also plans to elaborate a National Maritime Spatial Planning Strategy in 2020. To achieve SDG 15 on life on land, Greece highlights its efforts to complete forest mapping and finalise the national cadastre (Government of Greece, 2018).

Table 5.2. Greece's National Biodiversity Strategy targets (2014)

Target	Sub-target
1. Increased knowledge about biodiversity status assessment	1.1 Facilitate access to scientific knowledge regarding Greek flora and fauna and fill the gaps in scientific data. 1.2 Facilitate access to information on actions for biodiversity conservation and monitoring, as well as implementation of the strategy.
2. Conservation of national natural capital and ecosystem restoration	2.1 Conserve species and habitat types in Greek terrestrial and marine ecosystems to promote the goal of sustainability. 2.2 Restore important species and habitat types.
3. Organisation and operation of a National System of Protected Areas and enhancement of the benefits of their management	3.1 Effectively organise the administration and management of protected areas and implement preventive measures in protected areas. 3.2 Apply exemplary and innovative practices in productive sectors and tourism based on the area management plans for biodiversity conservation and management. 3.3 Design, and possibly integrate, ecological corridors and their effective management.
4. Conservation of genetic resources: facilitating access to genetic resources and fairly and equitably sharing the benefits arising from their use	4.1 Ensure access to scientific records of genetic resources and fill gaps in scientific data. 4.2 In situ and/or ex situ, conserve Greek genetic resources. 4.3 Facilitate access to genetic resources and ensure fair and equitable sharing of the benefits arising from their use. 4.4 Study, prevent and reduce the impact of genetically modified organisms on biodiversity.

5. Enhancement of synergies among the main sectoral policies for biodiversity conservation and setting of incentives	5.1 Effectively integrate biodiversity conservation at all levels of spatial planning. 5.2 Minimise the impact of large infrastructure projects. 5.3 Ensure compatibility of residential and industrial development activities (including conventional energy production) with biodiversity conservation. 5.4 Ensure the compatibility of tourist activities with biodiversity conservation. 5.5 Ensure the compatibility of agricultural, fishery and forestry activities with biodiversity conservation. 5.6 Ensure the compatibility of energy production and infrastructure (including renewables) with biodiversity conservation. 5.7 Ensure the compatibility of mining activities with biodiversity conservation. 5.8 Ensure the compatibility of other activities (e.g. hunting, collection of plants or animals) with biodiversity conservation.
6. Conservation of landscape diversity	6.1 Completely integrate conservation landscape diversity policy into all sectoral policies. 6.2 Maintain landscape diversity both inside and outside of protected areas. 6.3 Conserve unique landscapes.
7. Prevention and minimisation of the impact of climate change on biodiversity	7.1 Study the effects of climate change on biodiversity and ecosystem functions. 7.2 Act to enable the components of biodiversity to adapt to climate change. 7.3 Reduce the biodiversity impact of actions to address climate change. 7.4 Enhance the role of forests in mitigating the effects of climate change.
8. Protection of biodiversity from invasive alien species	8.1 Prevent, detect early and control the introduction and spread of invasive species. 8.2 Act to reverse the impact of invasive alien species on biodiversity.
9. Enhancing international co-operation for biodiversity conservation	9.1 Substantially enhance the effectiveness of international, regional and transnational co-operation for conservation of biodiversity and ecosystem services. 9.2 Enhance transboundary co-operation for biodiversity conservation.
10. Upgrading the quality and efficiency of public administration on biodiversity conservation	10.1 Improve public administration in organisational issues, scientific issues and decision making for effective implementation of policies, measures and legislation on biodiversity. 10.2 Ensure adequate funding for biodiversity conservation.
11. Integration of biodiversity conservation into the value system of society	11.1 Integrate biodiversity issues into formal and informal education and promote the value of biodiversity. 11.2 Promote environmental awareness in biodiversity conservation.
12. Inspiring citizen participation in biodiversity conservation	12.1 Establish co-operation among citizens, scientists and public administrations in decision making and monitor its implementation. 12.2 Promote the accountability of companies in the context of biodiversity conservation.
13. Gaining appreciation of ecosystem services and promoting the value of Greek biodiversity	13.1 Carry out valuation of ecosystem functions and services in social and economic terms. 13.2 Promote the value of biodiversity and the services provided by biodiversity and ecosystems. 13.3 Promote, establish and maintain natural green infrastructure.

Source: MoEE (2014), *National Biodiversity Strategy & Action Plan*.

5.3.2. Institutional framework

National level

The MoEE is responsible for environment and biodiversity at the national level through the General Secretariat for Natural Environment and Water. The ministry's role and organisation were restructured with a 2017 presidential decree and after the July 2019 elections. Its responsibilities are extensive and adequate staffing appears to be an issue. Within the secretariat are directorates responsible for natural environment and biodiversity and forest policy. The MoEE also supervises institutions with biodiversity-related responsibilities, such as the National Centre for Environment and Sustainable Development, responsible for the State of the Environment report; the Green Fund; and management bodies of protected areas.

Other ministries with responsibility related to biodiversity policy include the Ministry of Rural Development and Food (agriculture and fisheries) and the Ministry of Tourism. The Coast Guard, under the Ministry of

Maritime Affairs and Insular Policy, also assists the MoEE with activities related to biological diversity conservation. The Ministry of Foreign Affairs is responsible for implementation of international agreements, while the Ministry of Education and Religious Affairs is responsible for environmental education, including biodiversity issues.

Subnational levels

Each of the 13 regions has a directorate of environment and spatial planning responsible for ensuring compliance of certain projects with environmental requirements, including environmental impact assessment (EIA).

In 2018, Greece promulgated a law establishing management bodies for all protected areas, supervised by the national Natura 2000 committee, which is the central scientific advisory body on co-ordination, supervision and assessment of protected areas. Local Forest Services are responsible for forest protection and management, among other things.

Civil society

Civil society engagement in biodiversity matters has grown over the years. In 2018, the law establishing management bodies of protected areas included for the first time provisions for stakeholder consultation on management plans, under relevant management bodies. The 2014 NBSAP also went through public consultations. Synergies between the government and academia could be strengthened.

Non-government organisations (NGOs) in Greece include branches of international organisations and local and national organisations, such as the Hellenic Ornithological Society, which plays a key role in bird protection. NGOs have been quite active, issuing joint memos to the MoEE to improve the status of protected areas, as well as through legislative proposals. They regularly bring issues to court. A recent example is a complaint that new tourism zoning regulations breach the Habitats Directive and the Directive on Strategic Environmental Assessment.

NGOs work with private companies to ensure habitat and species protection through management and restoration, which also benefit from EU funding. Examples are the restoration of black pine forests after fires in the Peloponnese, conservation of coastal dunes and brown bear, and establishment of a network of plant micro-reserves. NGOs also undertake information dissemination and awareness-raising campaigns.

Private funding is limited to the contribution of large businesses and foundations, including financial institutions. A good example is the involvement of Piraeus Bank in management of the Stymfalia Lake Natura 2000 site.

5.4. Biodiversity monitoring and information

Greece has not yet established a national comprehensive monitoring system for biodiversity. The NBSAP includes targets for monitoring and evaluating its implementation, which should facilitate access to scientific knowledge regarding Greek flora and fauna and fill data gaps. A progress report on meeting targets is expected after the end of the action plan (MoEE, 2016). The LIFE-IP4 Natura project, which started in 2018 (Section 5.6), will also contribute to mapping and assessment of habitats and species in Natura 2000 sites.

The EU 2020 Biodiversity Strategy calls for mapping and assessment of the state of ecosystems and their services (MAES). While ecosystem services are discussed in the NBSAP as part of Greece's obligations under the CBD, this has not translated into cross-sectoral regulatory and institutional frameworks to date. A working group, the Hellenic Ecosystem Service Partnership (HESP), has been established to promote the ecosystem service approach in Greece. Its primary objective is to complete biophysical assessments and produce outcomes by 2020 to support decision making (Dimopoulos et al., 2017).

HESP has effectively co-operated with the MoEE on MAES, providing an encouraging example of collaboration between the academic sector and policy makers in advancing the biodiversity agenda. Important work has been conducted on assessing the cultural value of ecosystem services, a novel research area in Greece and abroad (Box 5.3).

Box 5.3. The cultural value of ecosystem services

Cultural landscapes are considered an interface between nature and culture, tangible and intangible heritage, cultural and biological diversity. In Greece, they account for some 67% of the Natura 2000 network. Efforts to study them have only recently been promoted in Greece and elsewhere in the Mediterranean; they are still poorly inventoried and evaluated. A 2017 study attempted a novel procedure to assess cultural landscape features and their cultural values in the major protected areas of Greece.

Researchers used spatial distribution land cover and EU/national designated habitat type to create a relational database that was linked to Natura 2000 sites' spatial data. To accomplish this, a classification of cultural vs natural landscape features was developed, following human-modified vegetation structure identified in published inventories. Twelve attributes involving cultural heritage values, traditional land uses and aesthetic quality indicators were scored to assess these "cultural values" at each site. These analyses help define the level of "culturalness" of each site and identify the protected areas that may require special attention.

Some examples are salines and related landscapes that were highlighted as highly important for the Greek and Mediterranean people. There have also been studies on the cultural significance of traditional agricultural landscapes in the Aegean islands, using cultivated terraces as case studies. Recent publications on contemporary sacred sites and trees in Epirus have focused on the awareness of younger generations.

Source: Vlami et al. (2017); Dimopoulos et al. (2017).

5.5. Policy instruments for biodiversity conservation and sustainable use

As in many OECD countries, regulatory (command and control) instruments are the preferred choice for biodiversity conservation, while voluntary and economic instruments remain marginally used. Expanding the latter (e.g. taxes, charges and fees, offsets, payments for ecosystem services) could help balance trade-offs between biodiversity objectives and economic activities, especially in sectors such as tourism and agriculture, which significantly affect biodiversity (Table 5.3).

Table 5.3. As in many OECD countries, regulatory instruments are predominant

Regulatory instruments	Economic instruments
Protected areas and species	Charges and fees (e.g. for natural resource use, access to national parks, hunting and fishing licences
Restrictions or prohibitions on use (e.g. hunting and fishing restrictions, trade in endangered species)	Charges and fees (e.g. for natural resource use, access to national parks, hunting and fishing licences)
Permits and quotas (e.g. on logging, fishing and hunting)	Non-compliance administrative fines for operators
Environmental impact assessment and strategic environmental assessment	
Land-use planning	

Source: adapted from OECD (2013), *Scaling-up Finance Mechanisms for Biodiversity*.

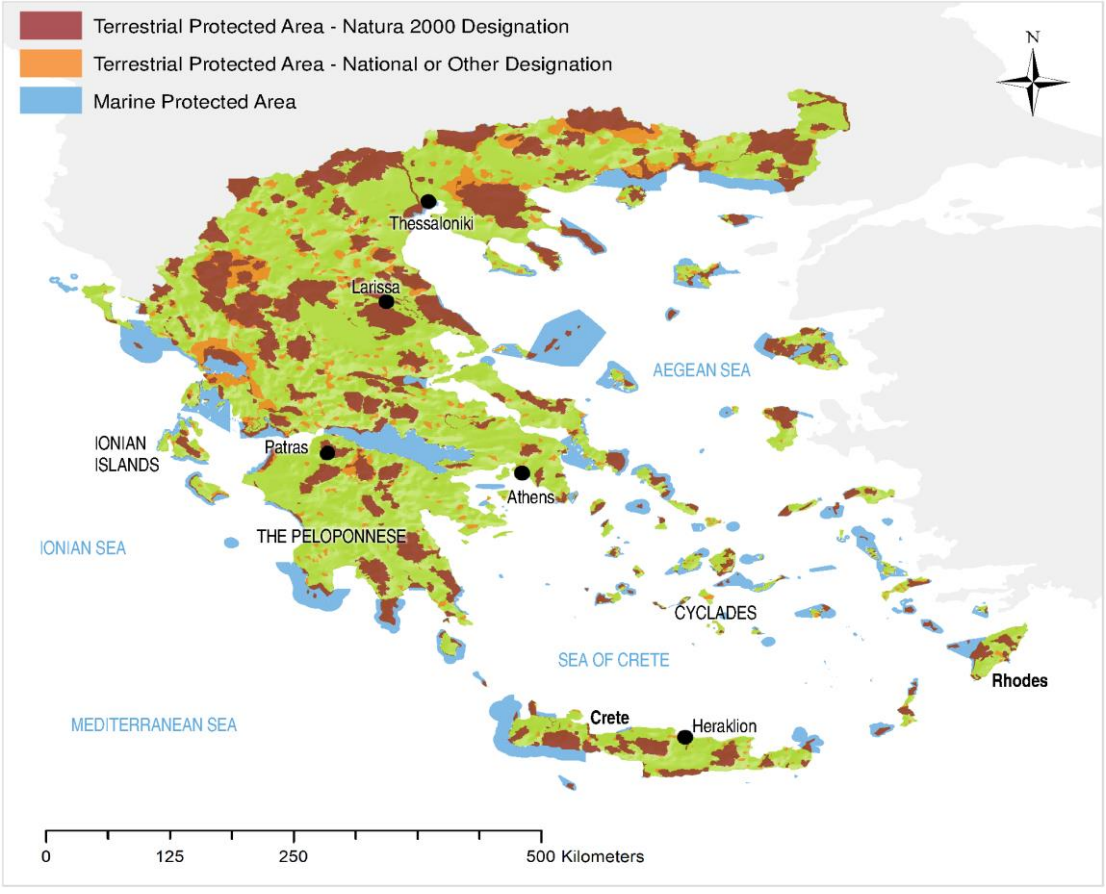
5.5.1. Regulatory instruments

Protected areas and species

According to national data, protected areas cover an extensive share (32%) of terrestrial areas, while marine protected areas account for 20% of the territorial sea (Figure 5.3). Greece thus achieved 2020 Aichi target 11 on terrestrial areas, which calls for reaching at least 17% of terrestrial and inland waters, especially areas of particular importance for biodiversity and ecosystem services, conserved through effective and equitable measures. The performance against Aichi target 11 to protect 10% of marine areas is less clear.[1] Most protected areas belong to the Natura 2000 network and a very small percentage is only nationally designated.

As the 2009 EPR recommended, in 2017 Greece expanded the Natura 2000 network, with a focus on marine areas. It has added 32 areas and extended the boundaries of 63 existing ones. There are 446 Natura 2000 sites.

Figure 5.3. There is an extended network of protected areas



Source: UNEP-WCMC and IUCN (2019), *The World Database on Protected Areas*.

Another important development was the 2018 law on establishing management bodies for all protected areas. It expanded territorial responsibility of the 28 existing bodies and established eight new ones. As a result, every Natura 2000 site has a management body, whose responsibilities and competences are regulated by the 2018 law. Management bodies are led by boards of seven people, appointed through an open call and acting in a voluntary capacity. They can include representatives of the MoEE, local

governments, NGOs, scientific bodies and productive sectors. The scientific community maintains there is insufficient scientific representation, hampering sound management of the areas.

While the 2018 law is a welcome development, Greece should make sure the management bodies are properly co-ordinated and sufficiently funded and staffed to carry out their functions. At the Schinias-Marathon National Park, for example, the management body's territorial responsibilities were expanded as a result of the law, but with no corresponding resource adjustment (Box 5.4). Capacity building and awareness raising are being done through LIFE Integrated Project LIFE-IP 4 NATURA, which should boost overall efforts.

Box 5.4. Schinias-Marathon National Park

Schinias-Marathon National Park is one of the most important coastal ecosystems and an area of high ecological value in Attica. It comprises a reconstructed wetland, pine forest, spring, bay, hill and residential and tourist area. It is also home to the Olympic rowing centre, whose construction impact was offset by an overflow basin that significantly improved the biodiversity of the wetland and park.

Since 2018, the management authority of the park has expanded its supervision to southeastern Attica by approximately doubling the areas under its responsibility. Resources, however, have not matched the expansion, which entailed increased risk, especially related to fire management. More financial and administrative resources are needed to properly manage the extended area. The management plan should also be revised to account for the enlargement.

Source: Management Board of Schinias-Marathon National Park (2019).

In terms of site management, the MoEE has allocated EUR 17.5 million to develop special environmental studies and draft presidential decrees and management plans to ensure adequate protection of the Natura 2000 network by 2022. This step is particularly welcome, especially in light of the latest EU Environmental Implementation Review, which said Greece should improve the management of Natura 2000 sites (EC, 2019b). In 2018 the European Commission urged Greece to respect its obligations under the Habitats Directive and establish conservation priorities, objectives and measures for all Natura 2000 sites.

Thus far only six management plans have been adopted, covering 2% of the network's area. While management plans are not mandatory, Greece should work to develop additional ones in identified priority areas, aimed at conserving threatened species. Its current objective is to develop management plans for all protected areas by 2022. This would also help it comply with a 2009 EPR recommendation calling for ensuring that all protected areas were provided with management plans and adequate conservation measures.

NGOs have expressed concerns about licensing of seismic research activities for hydrocarbon exploitation in Natura 2000 areas, Ramsar sites and at least four of the ten national parks (WWF, 2018). Lack of awareness among authorities and the public about Natura 2000 contributes to these concerns. Moreover, lack of incentives and low capacity to promote sustainable land use and mainstream in sectoral policies hamper biodiversity improvement (EC, 2019b).

With regard to protected species, in 2017 Greece issued three ministerial decisions endorsing action plans for protection of endangered species: national plans for the Egyptian vulture and the lesser white-fronted goose and a regional plan for the lesser kestrel in Thessaly. A total of 12 species and habitats action plans are being drafted via the LIFE-IP 4 NATURA project. These action plans are expected to be implemented over 2021-26. A further promising development was a 2018 ministerial decision on adoption of local action plans to tackle illegal use of poisonous bait. The decision is particularly important because it provides a

statutory framework for co-operation among authorities and other stakeholders on tackling this illegal activity more effectively (WWF, 2018).

There is a high number of complaints and infringement cases on degradation of designated sites, poor quality of appropriate assessments under Article 6(3) of the Habitats Directive, lack of strategic assessment and insufficient protection of species and habitats, also as a result of illegal activities (EC, 2019b).

Environmental assessment and other instruments

In accordance with EU requirements, Greece has a special procedure for conducting EIA in Natura 2000 areas, which involves a special ecological assessment. Strategic environmental assessment (SEA) was introduced in 2006. It is conducted for large-scale environment-related plans and programmes, including spatial plans, as well as EU-funded programmes (Chapter 2). SEA includes biodiversity as one of the environmental concerns. SEA is also mandatory for plans and programmes which require an assessment under the Habitats Directive. However, EIA and SEA do not always take sufficient account of potential impact on biodiversity (Box 5.5).

Box 5.5. Wind farm developments do not always take biodiversity into account

The NBSAP calls for ensuring the compatibility of energy production, including that based on renewables, with biodiversity conservation. However, the regulatory framework for wind farm development is relatively loose: wind farms can be established in Natura 2000 areas, with few exceptions. With wind energy developing fast, it is important to better integrate biodiversity considerations into EIA and SEA to avoid loss of birds and bats, especially in sensitive areas such as mountainous regions, wetlands and migration paths.

A 2017 study analysed the impact of wind farm developments in the eastern Rhodope Mountains, between Greece and Bulgaria, which include ten Greek special protection sites under the Birds Directive (2009/147/EC).

The results showed that if all planned turbines operated at once, predicted cumulative annual collision mortality would account for 50% of the standing population of birds and possibly lead to the extinction of certain species. The report offered science-based options to better integrate biodiversity considerations into SEA and EIA. It suggested running fewer turbines and only in the two outer zones of the area, which it said would allow the national energy production target to be met while minimising bird mortality.

Source: Vasilakis et al. (2017).

Other regulatory instruments include ministerial decisions prohibiting hunting in wildlife refuges, certain forest sites and areas 300 metres from the coastline, and hunting of certain species. However, hunting is not systematically restricted in Natura 2000 sites. There are fishing restrictions and prohibition of harmful techniques. Logging, fishing and hunting are subject to permits and quotas.

Additional regulations control international trade in threatened and endangered species. The General Police Directorate under the Ministry of Interior co-operates with Interpol to tackle crime against wildlife and forests.

Spatial planning

Spatial planning is governed by the 2016 Spatial Planning Law and the national General Framework for Spatial Planning, which provide strategic directions concerning land use and zoning at the national and regional levels. All plans undergo SEA. The abundance of special regimes for spatial planning and the lack

of statutory land-use plans create potential environmental risks. Illegal construction, particularly in coastal and forest areas, remains a major environmental concern (Chapter 2).

In 2018, Greece started updating Regional Spatial Planning Frameworks. The Crete framework, the first to be approved, has been criticised by NGOs as being controversial. Sectoral frameworks for tourism, industry, renewables and aquaculture are in the pipeline for updating and a new Special Spatial Planning Framework for mining is under preparation (WWF, 2018). Local spatial plans, revised every five years, take into account environmental protection rules for sensitive areas, biodiversity considerations and sector-specific restrictions such as limits on proximity to residential areas (Chapter 2).

The NBSAP, which includes integration of biodiversity considerations into spatial planning as a national target, finds the strategic directions of the national spatial planning law and framework insufficient to prevent local pressures within protected areas. Therefore, it is necessary to improve land-use plans at the local level.

Greece lacks an overarching framework for green infrastructure, which is a sub-target of the NBSAP and a target of the EU 2020 Biodiversity Strategy. Green infrastructure is a strategically planned network of natural and semi-natural areas whose purpose can include water purification, air quality, recreation and the like, aimed at improving environmental conditions and people's quality of life. To maximise its benefits, green infrastructure should be an essential component of spatial planning (EEA, 2019).

Greece currently lacks a legally binding national maritime spatial plan (there are plans to develop a National Maritime Spatial Strategy in 2020). Maritime planning issues are addressed in the national Spatial Planning Framework. Sectoral plans for aquaculture (Section 5.7) and tourism (under modification) include spatial planning guidelines for coastal and marine segments of each sector. Additionally, the renewables framework sets strategic guidelines for offshore wind parks.

5.5.2. Economic instruments

Greece applies few economic instruments for the conservation and sustainable use of biodiversity, which is a recommendation of the OECD environment acquis.[2] The 2009 EPR also recommended expanding the use of such instruments. Many countries apply various types of positive incentives to promote biodiversity conservation and its sustainable use, as called for in Aichi Target 3 under the CBD (OECD, 2018a). Economic instruments (e.g. taxes, fees and charges, tradable permits, payments for ecosystem service programmes and environmentally motivated subsidies), by applying the polluter-pays approach, help reflect costs of environmental impacts in decision making and provide signals to producers and consumers to behave in more environment-friendly ways. These instruments also help mobilise finance and generate revenue.

Greece has charges for groundwater extraction (charges and fees for natural resource use), limited fees for access to national parks, and hunting and fishing licence fees. There are no taxes on fertiliser and pesticide use, despite their success in some other OECD countries in addressing diffuse pollution from agriculture (Chapter 3). Nor are there biodiversity offsets, with the notable exception of Schinias-Marathon National Park (Box 5.4).

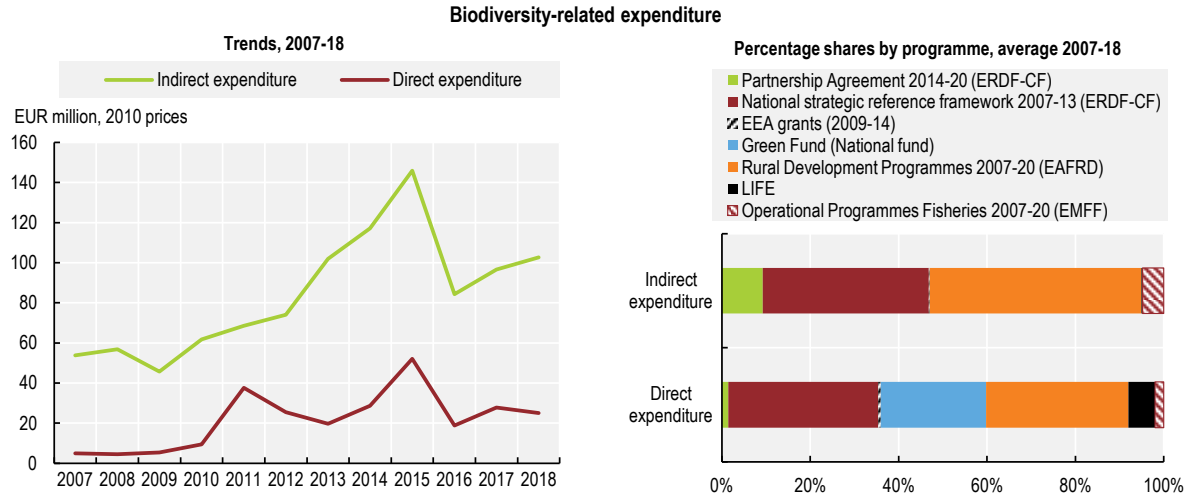
Environmentally favourable subsidies are provided in Greece for landscape and nature conservation and organic farming. Private owners are compensated for income loss in forest areas of Natura 2000 sites, a measure funded through the RDP. In general, subsides can be favourable or harmful to biodiversity. The former include measures that decouple support payments from non-commodity criteria and impose environmental requirements (Section 5.7.2).

Forms of support considered potentially the most harmful for biodiversity include payments based on commodity output and payments based on variable input use, without imposing environmental constraints (OECD, 2018b). One of the CBD's Aichi targets encourages countries to eliminate, phase out or reform harmful subsidies to minimise or avoid negative impacts. Greece subsidises farmers through an electricity tax exemption. Tax reductions and refunds on diesel used in agriculture have been phased out, but diesel used for domestic shipping, including fishing and tourist boats, is untaxed, as provided by the Energy Taxation Directive (Chapter 3).

5.6. Financing biodiversity management

Biodiversity expenditure (direct and indirect) has more than doubled over the last ten years. However, direct expenditure (i.e. when biodiversity conservation and sustainable use is the main objective of the project) accounts for around one-quarter of indirect expenditure (Figure 5.4). Funding for biodiversity relies mostly on EU funds. On the basis of partnership agreements, members draw up operational programmes in which they set out how they intend to invest EU funds. In the current programming period, 2014-20, biodiversity objectives are included in the sectoral programme on environment as well as in the 13 regional programmes. Territorial co-operation programmes (mainly Interreg V) also provide funds to certain biodiversity projects. For this financing period, EUR 128 million in EU funds and national contribution was allocated for biodiversity.

Figure 5.4. Indirect expenditure is much higher than direct expenditure



Note: Expenditure reported according to the Convention on Biological Diversity requirement, targeting biodiversity conservation and sustainable use either directly (main project objective) or indirectly (20% or 40% of coverage of the objective). The projects concerned fall into the following categories: financing of protected area management bodies; protection and upgrading of forests; conservation of endangered indigenous farm animal breeds and of genetic resources in livestock. Financing comes from national and EU structural and investment funds, including the European Regional Development Fund (ERDF), the Cohesion Fund (CF), the Agricultural Fund for Rural Development (EAFRD) and the European Maritime and Fisheries Fund (EMFF).
Source: Country submission.

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The Prioritised Action Framework (PAF) for Natura 2000 is a policy planning tool for funding the areas of the network by setting priorities at the national and regional levels. Greece's PAF for the current period amounts to almost EUR 700 million. All management bodies for Natura 2000 sites are funded by the environmental sector programme and, to a lesser extent, by regional operational programmes. Greece should take the opportunity of the upcoming programming period to streamline and improve management of EU funds. To this end, it should assess its biodiversity priorities and direct funds where they are most needed.

Greece participates in the LIFE programme, which over 2009-18 co-financed 35 projects, with an EU investment of EUR 43 million. The most recent project is LIFE-IP4 Natura (total budget EUR 17 million, of which EUR 10.2 million is EU funding), which runs 2018-25. Among other outputs, it aims at mapping and assessing ecosystems and their services at the national level. It also monitors implementation of the prioritised action framework for Natura 2000. The projects also aim at mobilising funds from various sources for specific conservation actions.

At the national level, the Green Fund, fed mostly by fines for environmental offences, funds environmental projects, including in forests and marine and protected areas. Over 2012-17, its expenditure for biodiversity-related projects reached about EUR 45 million.

There is little information on private-sector financing for biodiversity. The MoEE has reported that private funds amount to around EUR 0.5 million per year for Natura 2000 sites. For more effective financing of biodiversity management, Greece would need to augment public financing with private-sector finance.

5.7. Mainstreaming biodiversity into economic sectors

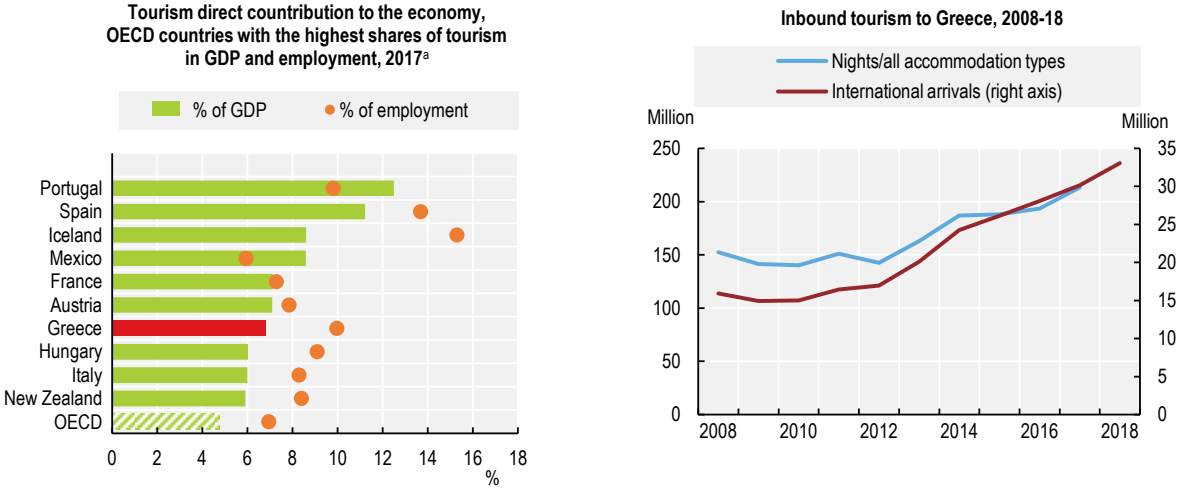
Greece needs to better mainstream biodiversity into other economic sectors by making explicit links between ecosystem services, biodiversity conservation and sustainable use of resources in key policy areas. Target 5 of the NBSAP indicates the need to enhance synergies among the main sectoral policies concerning biodiversity conservation. The eight sub-targets focus on integration of biodiversity considerations into key sectors such as energy, tourism, agriculture, forestry and fisheries.

Natural resources are the basis of important sectors such as agriculture, fisheries and aquaculture, and tourism. Forests, wetlands and coasts are fundamental in providing ecosystem services, such as clean air, water, soil and fish stocks, and this is recognised by the public and by policy makers (MoEE, 2016). Many pressures on biodiversity stem from policies outside the purview of the MoEE, such as fisheries, agriculture and tourism. Therefore, it is important to harness synergies among policy areas and minimise potential trade-offs.

5.7.1. Tourism

As tourism expands in Greece, it will be increasingly important to create links between the sector and national biodiversity priorities. Tourism significantly contributes to the Greek economy in terms of direct GDP and employment, with shares that are among the largest in the OECD. The number of tourist arrivals has been steadily growing, even during the economic crisis (Figure 5.5).

Figure 5.5. Tourism accounts for a large share of the Greek economy and has been growing



a) 2017 or latest year available. Data for Greece refer to tourism gross value added of industries 55-56 of NACE Rev. 2 only. According to the Greek Tourism Confederation (SETE), the total direct GDP contribution of the tourism industry was 11.7% in 2018. Data for France refer to international tourism consumption. Data for Spain include indirect effects.
Source: OECD (2019), *OECD Tourism Statistics* (database); National Bank of Greece (2019), *Travel Services* (database).

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The largest impact of tourism is in coastal areas due to infrastructure development, including roads leading to tourist destinations, and overcrowding on beaches. The seasonal nature of tourism in such areas puts pressure on the environment during the peak summer season, including increased water demand during dry periods, especially on islands. Overpumping can cause irreversible salinisation of groundwater aquifers. Tourism also contributes significantly to municipal solid waste volumes, requiring greater effort for local authorities to manage. OECD work on the ocean economy, including coastal and marine tourism,

could help Greece harness the benefits of ocean-based industries as well as protect marine ecosystems (Box 5.6).

Box 5.6. The ocean economy

The OECD defines the ocean economy as the sum of the economic activities of ocean-based industries and the assets, goods and services provided by marine ecosystems. Much economic activity associated with the ocean depends on marine ecosystems, and at the same time affects them. Tourism is a key sector of the ocean economy.

Various options are available for countries that wish to integrate ocean economic activities and protection of marine ecosystems. These rely on collecting robust data by developing standardised approaches to measuring and valuing ocean industries, and integrating them into national accounting via satellite accounts. In addition, marine ecosystem considerations should be mainstreamed into national development strategies, marine spatial plans and tourism strategies, among others. Effective policies must be put in place to ensure that externalities are addressed and that robust monitoring and evaluation of mainstreaming occur over time.

Source: OECD (2019b).

The NBSAP includes several actions to achieve sub-target 5.4 (Table 5.2) on the compatibility of tourist activities with biodiversity conservation. Key actions include developing ecotourism and agro-tourism, establishing frameworks for infrastructure development, especially in protected areas, and defining monitoring indicators. The Green Tourism Initiative, run by the Ministry of Tourism, aims at improving performance among micro, small and medium-sized tourism enterprises. In particular, through this programme, tourism enterprises are financially supported to improve their resource and energy efficiency and encouraged to promote ecologically wise characteristics of destinations (Government of Greece, 2018). To date, however, it is unclear where Greece stands with respect to this initiative and national targets. The development of the National Maritime Spatial Strategy in 2020, along with the updated Spatial Planning Framework for Tourism, could lead to more effective management of coastal and marine areas.

In July 2019, the minister of tourism presented the new tourism strategy in the parliament. It has five pillars, including one on social and environmental sensitivity. In addition, ad hoc initiatives sponsored by the EU and the European Bank for Reconstruction and Development aim to reduce pressures from tourism, including by diversifying destinations and combatting overtourism (Aristeidou, 2019).

In the 2019 National Strategy for Sustainable and Fair Growth 2030, ecotourism is suggested as a tool for development of the port and shipbuilding sectors, aimed at making Greece a world cruise destination and facilitating mega-yacht chartering (Chapter 3).

For mountain areas, a 2017 law sets specifications for planning, constructing and maintaining trekking routes and hiking trails to promote sustainable tourism practices. There is an electronic registry of trails, and a national certification system of mountain routes is being developed. Such initiatives are supported by the Green Fund.

Environmental projects related to the tourism sector are funded under the 2014-20 Operational Programme Competitiveness, Entrepreneurship and Innovation. Eligible projects include upgrading of buildings to improve their energy performance, energy efficiency measures, water and waste management actions, and environmental awareness initiatives. To date, 102 investment plans for tourist accommodation have been completed, for a total budget of EUR 14.5 million.

5.7.2. Agriculture

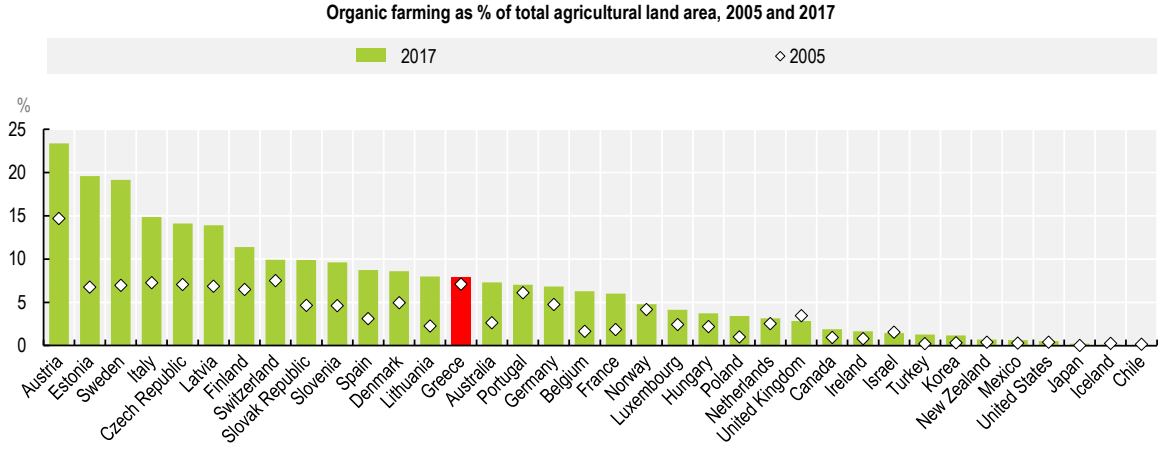
Biodiversity mainstreaming into agriculture is mostly done through the RDP, the second pillar of the Common Agricultural Policy. The RDP focuses on enhancing farm viability and competitiveness, preserving and enhancing ecosystems and promoting local development in rural areas. The NBSAP actions related to mainstreaming biodiversity into agriculture are not very specific: they refer to improving the sustainable management of agricultural ecosystems. The 2009 EPR recommended improving the integration of biodiversity concerns into the agricultural sector.

Agricultural policy is under the purview of the Ministry of Rural Development and Food (MRDF), which co-operates with the MoEE on several environmental issues, including biodiversity. The MRDF has a Directorate for Environment, Spatial Planning and Climate Change.

Over 2014-20, EUR 2.8 billion, almost half the RDP budget, is allocated to restoring, preserving and enhancing ecosystems related to agriculture and forestry. The RDP supports farmers to put 17.4% of farmland under contract to preserve biodiversity (relating to agri-environmental programmes, Natura 2000, afforestation and other biodiversity protection payments), 17.3% to improve water management and 20.6% to improve soil management and prevent soil erosion (EC, 2019a). However, the net effects of agri-environmental measures of the RDP on biodiversity would require a more detailed assessment in order to improve their effectiveness under the next RDP.

Around 20% of Natura 2000 is used for non-intensive agriculture. There are no quantitative national targets on organic farming, which can benefit biodiversity by reducing the use of chemical fertilisers and pesticides and limiting livestock density. Organic farming increased from 7% of agricultural area in 2005 to 9% in 2018, above the 2017 OECD average of 7% (Figure 5.6). Despite significant EU support (EUR 0.8 billion over 2014-20), the share has grown less rapidly than in most countries.

Figure 5.6. Organic farming has increased less rapidly than in most other OECD countries



Note: 2017 or latest year available.
Source: OECD (2019), "Environmental performance of agriculture - indicators", *OECD Agriculture Statistics* (database).

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There are ad hoc initiatives that contribute to biodiversity conservation. In 2019, Greece organised a working group to assess available data and information to set up a national soil map. In addition, the Agricultural University of Athens has carried out a study to develop action plans in nitrate-vulnerable zones. The plans are also expected to improve farmers' compliance and strengthen the protection regime of water resources. In the framework of the 2013 National Action Plan for the Sustainable Use of Pesticides, a draft Joint Ministerial Decision is under preparation to improve enforcement of regulations on pesticide use.

5.7.3. Fisheries and aquaculture

Despite a significant decrease in the last ten years, Greece has the largest fishing fleet in the EU in terms of number of ships. Mainstreaming of biodiversity into fisheries is mainly done through control of fishing inputs and methods, including restricted areas for fish juveniles, and banning of drift nets and of pelagic trawling, which have a severe impact on protected aquatic fauna (e.g. bycatch of sea mammals and water birds). In addition, fishing is restricted in certain periods (e.g. during spawning season) to conserve habitats and protect endangered aquatic organisms. More stringent restrictions are applied in protected areas and priority habitats, such as the Posidonia meadows, a Natura 2000 site.

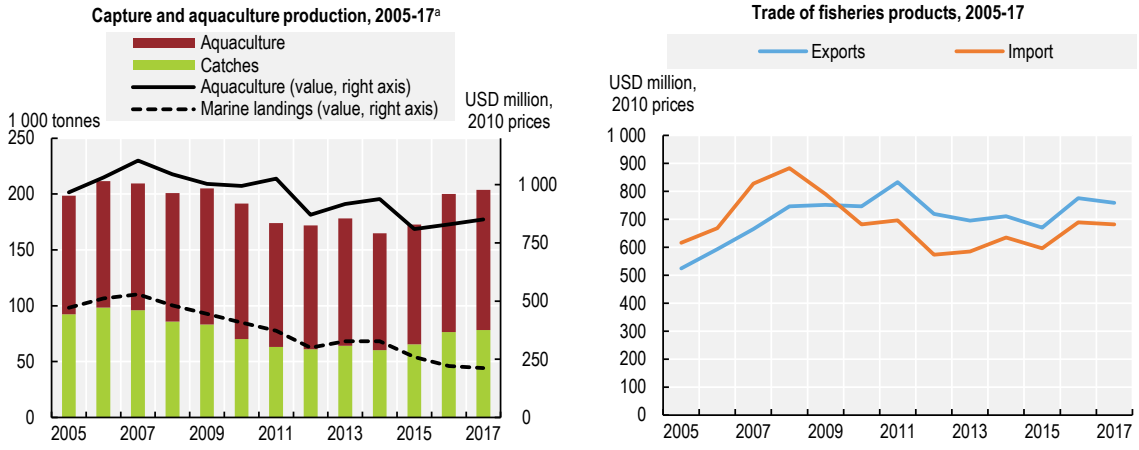
In practice, however, restrictions are not always enforced. Consequently, associated ecosystem services, such as habitat provision and coastal protection, are affected (Tsakalou, 2018).

Fisheries are under the purview of the MRDF. Like other sectors, fisheries and aquaculture are governed by EU policy, namely the Common Fisheries Policy. Targets of the NBSAP include revising the regulatory framework for fisheries, based on conservation needs of species and habitat types, and enhancing the capability of port authorities to control illegal recreational fishing.

Fish stock data for 2015-16 indicate hake (Merluccius merluccius) in the Aegean Sea is subject to overfishing, while other species, including mullet, pink shrimp, anchovy and sardine, remained either stable compared to the previous monitoring period or increased (OECD, 2017). Greek fishery production, including aquaculture, increased only slightly over 2005-17, with aquaculture accounting for the largest growth. Values have fluctuated with prices over the last decade (Figure 5.7).

Aquaculture production grew steadily over 2005-09 and is now recovering after the slowdown caused by the economic crisis. The average annual growth rate of 7.8% in real value since 2015 has been aided by a general trend in higher prices for products and increased export demand. In 2017, aquaculture accounted for 62% of total fishery volume (Figure 5.7). Compared with organic farming, organic aquaculture is in its infancy, with only a few farms certified.

Figure 5.7. Aquaculture accounts for a large share of total fisheries



a) Production of fish, crustaceans, molluscs and other aquatic animals in marine areas and inland waters (in 2017, inland waters contributed to about 1% and 2% of total capture and aquaculture production respectively). Aquaculture and inland fisheries volumes are expressed on a live weight basis, marine landings on a landed weight basis.

Source: FAO (2019), *FishStat* (database); OECD (2019), *OECD Fisheries and Aquaculture Statistics* (database).

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The Greek Operational Programme for 2014-20 under the European Maritime and Fisheries Fund (EMFF) has two main priorities: sustainable fisheries and sustainable aquaculture. The overall budget allocation amounts to EUR 523 million, of which EUR 135 million comes from the national budget. The axis on sustainable fisheries envisages investment in modernisation of fishing shelters and landing sites, increased

partnership between fishers and scientists, the creation and monitoring of artificial reefs, and protection and restoration of marine biodiversity.

The aquaculture axis aims at fostering environmentally sustainable, resource-efficient and knowledge-based aquaculture. The EMFF supports actions to improve innovation in the sector, such as developing technical, scientific or organisational knowledge and new aquaculture species, products and processes. Additional objectives include reducing water and chemical use and increasing energy efficiency (OECD, 2017).

To simplify complex administrative procedures and codify existing national and EU legislation, a law for the development of aquaculture was approved in 2014. It established the National Aquaculture Development Programme, with objectives for the sector; the National Council for Aquaculture to implement the programme; and simplified (one-stop shop) licensing procedures (OECD, 2017).

Special management plans are in place for certain species, such as tuna, swordfish and albacore. Fishing these species is permitted only by vessels that obtain special permits and are equipped with specific equipment.

Greece is in the process of establishing a marine strategy, in line with the requirements of the EU Marine Strategy Framework Directive, which requires the development of country strategies in order to achieve good environmental status in all European seas by 2020 (MoEE, 2016).

5.7.4. Forestry

Integration of biodiversity goals in forestry policy has a relatively long tradition. Since 1920, Greece has applied sustainable management practices for logging and grazing and has adopted strong legal protection for forests and woodlands. Some 40% of forested and wooded area is protected under Natura 2000, but there is a lack of biodiversity-related measures outside protected areas. In particular, it is important to conserve old-growth stands, which are vital habitats for forest birds. The MoEE has signed an agreement with the Institute of Mediterranean and Forest Ecosystems for implementation of a programme concerning the development of a Greek national system for the certification of sustainable management of forests and wood products.

The National Forest Strategy, adopted for 2018-38, represents a big step towards implementing sustainable forest management. It endorses the “Mediterranean forestry model”, which aims at strengthening the multifunctional role of forest ecosystems. The strategy identifies specific objectives as well as the necessary resources and means of implementation. It promotes land-use and land-use change policies to preserve ecosystem services (microclimate, water regulation, soil protection); maintenance of forest land coverage and connectivity to preserve habitats and biodiversity; afforestation and restoration of degraded forests; assessment and management of Greek forest genetic diversity; and use of climate-resilient genetic material.

The MoEE General Directorate of Forests and Forest Environment is responsible for forest policy. Forest Services are local public authorities responsible for the protection and management of public forests and forested areas and for supervision of private owners. Forest Services issue hunting permits and are responsible for controlling illegal logging and preventing fires (Section 5.2.2).

Management plans are prepared by the owner (public official or private consultant) and examined, certified and approved by the local Forest Service. Plans aim at assessing the situation and indicate management tools and protection measures, which cover sustainable management. Plans are carried out for ten years.

Additional tools include the EU Action Plan on Forests, which supports sustainable management of forests and their multifunctional role. One of its objectives is to “maintain and appropriately enhance biodiversity, carbon sequestration, integrity, health and resilience of forest ecosystems at multiple geographical scales”. Moreover, Greece implements the EU Action Plan for Forest Law Enforcement, Governance and Trade, addressing illegal logging and associated trade (MoEE, 2016). Greece participates in the Ministerial Conference on the Protection of Forests in Europe, a high-level political initiative for forest protection and sustainable management.

Data gaps on forestry make it difficult to determine forest cover and intensity of use. As of 2019, forest maps had been drafted for 97% (but ratified for slightly more than half) of the territory and the objective is to complete the mapping by the end of 2020.

Funding is provided by the EU, including the RDP for Natura 2000 forest sites. As in other EU countries, at least 30% of RDP funding must be dedicated to measures relevant to the environment and climate change. In the MoEE, the budget for the sector covers forest protection, sustainable management, afforestation of rural areas and other non-forested land, and prevention measures for biodiversity and climate change issues.

Recommendations on biodiversity conservation and sustainable use

Improving biodiversity data and information

- Continue to improve knowledge of the extent and value of ecosystem services, habitats and species within and outside protected areas. Complete the mapping and assessment of ecosystem services, in co-operation with all relevant stakeholders and in line with commitments under the Convention on Biological Diversity and the EU 2020 Biodiversity Strategy. Update the red list of threatened species.

Implementing effective policy instruments

- Complete management plans for all protected areas, with legal force and sufficient resources for implementation. Ensure consistent and effective implementation of existing plans. Create ecological corridors to reduce fragmentation.
- Support municipalities in effectively implementing local spatial plans that integrate biodiversity considerations. Develop a strategic policy framework for green infrastructure.
- Identify the priority research and data gaps that need to be filled to better prevent and manage the spread of invasive alien species.

Mainstreaming biodiversity in tourism, agriculture, fisheries, forestry

- Promote the use of relevant indicators and frameworks for infrastructure development to reduce or mitigate the impact of tourism and related infrastructure on biodiversity. Monitor progress towards the relevant NBSAP actions. Support sustainable tourism initiatives and promote thematic forms of tourism in line with protection and conservation of resources. Consider expanding financing sources, including visitor fees to protected areas and fees for tourism operators.
- Provide training and technical assistance to farmers to better implement agri-environmental measures under the RDP so as to reduce pressures on biodiversity. Increase the share of organic farming.
- Introduce additional measures to improve the sustainability of fisheries, including expanding management plans for overexploited species and special habitats. Revise the regulatory framework for fisheries, in accordance with the NBSAP.
- Upgrade the national forestry accounts. Explore opportunities to increase the use of economic instruments for forest conservation, such as payments for ecosystem services, while introducing sustainable management certifications for forestry and derived products.

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Notes

[1] Using harmonised international data for the denominator, the percentage of marine protected areas in Greece is less than 5% (OECD, 2019a).

[2] OECD Council Recommendation C(2004)81 – Recommendation of the Council on the Use of Economic Instruments in Promoting the Conservation and Sustainable Use of Biodiversity.

OECD Environmental Performance Reviews

Greece 2020

Greece has undergone extensive reforms to cope with a deep recession over the past decade. It has made progress in decoupling air pollutant emissions from GDP and improving the conservation status of natural habitats. However, the country faces challenges in managing waste and water, and addressing air pollution. It is highly vulnerable to the impact of climate change. The energy mix has shifted towards cleaner fuels, but the economy strongly relies on fossil fuels. Progress towards sustainable development requires effective implementation of ambitious climate mitigation and adaptation policies, strengthening environmental governance and enhancing coherence between environmental and energy, transport, agriculture and tourism policies.

This is the third Environmental Performance Review of Greece. It evaluates progress towards sustainable development and green growth, with special features on climate change mitigation and adaptation, and biodiversity conservation and sustainable use.

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