X ENVIRONMENT, ENERGY AND CLIMATE CHANGE

Humanity's fight to prevent catastrophic climate change is still at a critical phase, all the more so in an environment that has worsened over the past 12 months. However, the 29th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP29, November 2024), despite taking place under adverse conditions, set a new, higher New Collective Quantified Goal on Climate Finance to developing countries. In the EU, important legislative acts on green transition that had been pending were adopted in mid-2024, while in February 2025 the European Commission announced its proposals for combining competitiveness and climate neutrality ("Clean Industrial Deal", a set of measures for simplifying rules and reducing the administrative burden). Finally, the latest report of the International Energy Agency underscores the need for faster expansion of global renewable energy capacity, in view of geopolitical tensions.

1 GLOBAL DEVELOPMENTS AND POLICIES ON CLIMATE CHANGE AND ENERGY, SCIENTIFIC PROGRESS AND REPORTS[1]

Humanity's fight to prevent catastrophic climate change is still at a critical phase, all the more so in an environment that has worsened over the past 12 months, given that:

First, the fallout of the wars in Ukraine and the Middle East continue to affect energy supply and prices, as well as the free movement of raw materials and commodities.

Second, protectionism, which hampers global trade in critical raw materials or products necessary for green transition, e.g. electric cars, has markedly risen following the US President's announcements and decisions on tariffs after he assumed office on 20 January 2025.[2]

Third, on 20 January 2025, the newly elected US President decided the United States' immediate withdrawal from the Paris Agreement and from any agreement, pact, accord, or financial commitment made under the United Nations Framework Convention on Climate Change (UNFCCC), as well as the immediate revocation of the US International Climate Finance Plan.[3]

Fourth, as regards the EU, the adoption and entry into effect of three important legislative acts[4] was completed in mid-2024, which constitutes a very positive development; however, Member States' efforts to implement the comprehensive package of measures that had already been decided upon in order to achieve climate neutrality in the medium term continue to come up against restrictive fiscal rules and fiscal tightness, making it difficult to finance relief measures for those affected by climate actions – these difficulties are considerably mitigated by the focus of the Recovery and Resilience Facility (RRF) on green transition. More recently, on 26 February 2025, the European Commission took major initiatives, proposing: (a) the Clean Industrial Deal,

1 The cut-off date for information and data used in this chapter is 24 March 2025. For information on the Bank of Greece's sustainability and climate actions in 2024, see the Bank's Annual Financial Report (in Greek).
2 See https://www.whitehouse.gov/presidential-actions.
3 See https://www.whitehouse.gov/presidential-actions/2025/01/putting-america-first-in-international-environmental-agreements/.
4 European Critical Raw Materials Act, Net-Zero Industry Act and Nature Restoration Law. As regards the subject matter of these legislative acts, see Bank of Greece, Annual Report 2023, p. 230.

with the dual aim of strengthening competitiveness and achieving climate neutrality,[5] and (b) a package of measures to simplify EU rules, reduce administrative burdens, boost competitiveness and unlock additional investment capacity.[6]

Fifth, global average temperature continues to rise. According to the Copernicus Climate Change Service, 2024 was the warmest year on record and the first calendar year during which the increase in global temperature exceeded 1.5°C above pre-industrial levels (1.60°C increase).[7] Also, January 2025 was the warmest on record, with the Arctic sea ice extent falling to a record low and the ocean temperature reaching a peak.[8] These developments were coupled with widespread and intensifying extreme weather events associated with climate change around the world,[9] that led to the loss of human lives, destruction of infrastructure and severe consequences for the economy, the environment and biodiversity, while at the same time burdening government budgets and the private insurance sector.[10]

Sixth, public opinion is increasingly discontent with policies for tackling climate change, voicing concern about who will bear the brunt of the green transition; thus, extreme political forces that deny climate change are gaining ground in some countries.

The 29th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP29), hosted in Baku, Azerbaijan, from 11 to 22 November 2024, took place under adverse circumstances,[11] due to the worsening conditions mentioned above. Yet, important decisions were made following tough negotiations. (a) The Conference called on all actors to work together to scale up financing to developing countries, from both public and private sources, to at least USD 1.3 trillion per year by 2035, setting a goal (New Collective Quantified Goal on Climate Finance) of at least USD 300 billion annually for this purpose by 2035.[12] (b) It was decided to proceed with the long pending implementation of Article 6 of the Paris Agreement on a centralised carbon market under the UN and on country-to-country trading of carbon credits.[13] (c) Following strong pressure from oil-producing countries, the general stance adopted in COP28 in favour of eliminating fossil fuels was not expressly reiterated, nor was it reversed though.

On 7 November 2024, ahead of the COP29, the United Nations Environment Programme (UNEP) released its *Adaptation Gap Report 2024: Come hell and high water*, highlighting the

5 See https://commission.europa.eu/topics/eu-competitiveness/clean-industrial-deal_en and https://commission.europa.eu/document/download/9db1c5c8-9e82-467b-ab6a-905feeb4b6b0_en?filename=Communication%20-%20Clean%20Industrial%20Deal_en.pdf.

6 The proposals "cover a far-reaching simplification in the fields of sustainable finance reporting, sustainability due diligence, EU Taxonomy, carbon border adjustment mechanism, and European investment programmes". See https://ec.europa.eu/commission/presscorner/detail/en/ip_25_614.

7 See https://climate.copernicus.eu/copernicus-2024-first-year-exceed-15degc-above-pre-industrial-level.

8 See https://climate.copernicus.eu/january-2025-warmest-january-and-lowest-arctic-sea-ice-extent-month.

9 Notable examples over the past 12 months are the floods in Valencia, Spain, and the wildfires in the metropolitan area of Los Angeles, US.

10 On 18 December 2024, the European Insurance and Occupational Pensions Authority (EIOPA) and the ECB released a joint paper with a proposal designed to reduce the economic impact of natural catastrophes in the EU, envisaging an EU public-private reinsurance scheme to increase and diversify the insurance coverage for natural disaster risk and an EU Fund (financed by contributions from Member States) for public disaster financing. See also footnote 43 below.

11 Indicatively, the G20 Rio de Janeiro Leaders' Declaration of 19 November 2024, despite advocating sustainable development, did not contain any specific quantified commitments by major countries finance developing countries, or an explicit reference to decarbonisation. See https://www.gov.br/planalto/pt-br/media/18-11-2024-declaracao-de-lideres-g20.pdf.

12 See https://unfccc.int/news/cop29-un-climate-conference-agrees-to-triple-finance-to-developing-countries-protecting-lives-and and https://unfccc.int/sites/default/files/resource/cma2024_L22_adv.pdf. The UN Climate Change Executive Secretary, Simon Stiell, characterised the decision as "an insurance policy for humanity" – see https://unfccc.int/ news/this-new-finance-goal-is-an-insurance-policy-for-humanity-simon-stiell-at-close-of-cop29.

13 See https://unfccc.int/news/cop29-un-climate-conference-agrees-to-triple-finance-to-developing-countries-protecting-lives-and and https://unfccc.int/sites/default/files/resource/cma2024_L22_adv.pdf.

need for a massive scale-up of climate adaptation efforts and finance to avert a catastrophic temperature rise.[14]

Also, on 12 November 2024, ECB President Christine Lagarde warned that complacency in fighting climate change and preserving biodiversity is endangering our economic survival.[15]

After the 15th UN Biodiversity Conference (COP15, Montreal, December 2022), the 16th Conference (COP16) was held in Cali, Colombia, from 21 October to 1 November 2024. Although no agreement was reached on financial aid to developing countries for the preservation of biodiversity,[16] progress was made on a number of other issues.[17] As ECB representative Frank Elderson pointed out in his contribution, 72% of non-financial businesses in the euro area would experience significant problems as a result of ecosystem degradation.[18] After a suspension of discussions, the COP16 resumed in Rome on 25-27 February 2025, mainly focusing on funding issues. Using as a starting point the proposals of COP16 President Susana Muhamad[19] and then of Brazil, an agreement was reached[20] on a strategy for resource mobilisation (as part of existing funding instruments, but also new ones that could be created), in order to achieve by 2030 the targets set in 2022.[21] The outcome of COP16 was seen as a success for international cooperation.[22]

As regards the evolution and prospects of power generation capacity worldwide, the latest report of the International Energy Agency[23] stresses that geopolitical tensions reinforce the need for faster expansion of clean energy. Among other things, the report foresees, based on alternative scenarios, an increase in nuclear capacity and generation, albeit at a slower pace than other low-emissions power technologies. It should be recalled that nuclear energy qualifies as "green" in the EU's investment taxonomy, subject to specific criteria.

Progress in nuclear energy was mixed in 2024. The UK is leading the way by its long-established Joint European Torus, to be replaced by the Spherical Tokamak for Energy Production (STEP), as announced in February 2024 (see *Bank of Greece Annual Report 2023*, p. 231), aspiring to supply fusion-based electricity to the grid by the 2040s. On 16 January 2025, the British government announced GBP 410 million investment in 2025-2026, to accelerate the development of fusion energy.[24] On the other hand, France's fusion power project ITER (International Thermonuclear Experimental Reactor), which began years ago in southern France with the collaboration of 35 countries, faced numerous setbacks (both internal and external) and, as announced in summer 2024, will not be ready to operate before 2034, nine years behind schedule.[25]

For more information on the financing of climate change adaptation and the role of central banks and supervisory authorities, see Box X.1. For the social implications of the new EU emissions trading system (EU ETS2), due to become fully operational by 2027, see Box X.2.

14 See https://www.unep.org/news-and-stories/press-release/huge-uplift-needed-climate-adaptation-starting-finance-commitment.
15 See https://www.ecb.europa.eu/press/blog/date/2024/html/ecb.blog20241112~8eff6b9405.en.html.
16 For finance issues over the period 2015-2022, see OECD report Biodiversity and Development Finance 2015-2022, 18.9.2024.
17 For COP16 decisions, see https://www.cbd.int/conferences/2024.
18 See https://www.bankingsupervision.europa.eu/press/speeches/date/2024/html/ssm.sp241028~b3c4437ba0.en.html.
19 See https://www.cbd.int/article/reconvene-cop16-rome-2024 and https://www.cbd.int/doc/c/7d83/4cc1/1674fb979fefc6f9351ab816/cop-16-inf-43-rev1-en.pdf.
20 See https://www.cbd.int/doc/press/2025/pr-2025-02-27-cop16-en.pdf.
21 These targets refer to closing the biodiversity finance gap by mobilising USD 200 billion per year by 2030, of which USD 30 billion (up from USD 15 billion in 2022, based on OECD data) as aid to developing countries.
22 It should be noted that the United States has not ratified the UN Convention on Biological Diversity and, unlike the previous Conferences that it had attended as an observer, was totally absent from the COP16.
23 See International Energy Agency, World Energy Outlook 2024, October 2024. See also https://www.iea.org/news/geopoli- tical-tensions-are-laying-bare-fragilities-in-the-global-energy-system-reinforcing-need-for-faster-expansion-of-clean-energy.
24 See statements by the UK's Energy Secretary and Minister for Climate.
25 See "Giant international fusion project is in big trouble", *Science* (AAAS), 3.7.2024.

Below is a list of noteworthy activities, studies and other publications on incorporating climate change considerations into financial, regulatory and supervisory frameworks:

– Network of Central Banks and Supervisors for Greening the Financial System (NGFS):

(a) research reports, including on financial institutions' transition plans,[26] the macroeconomic impacts of climate change and the implications for monetary policy,[27,28,29] and climate adaptation finance;[30]

(b) issuance of recommendations and practices for the incorporation of sustainable and responsible investment principles in central banks' portfolios,[31] as well as for central banks' climate-related disclosures,[32] and publication of the final framework for integrating nature-related financial risks into the actions of central banks and supervisors;[33]

(c) development of tools, such as new climate stress testing scenarios[34] and a handbook for climate macroeconomic modelling.[35]

– Basel Committee on Banking Supervision (BCBS): discussion paper on the role of scenario analysis in the management and supervision of climate-related financial risks.[36]

– European Banking Authority (EBA): guidelines on the management of environmental, social and governance (ESG) risks[37] and publication of an analysis on greenwashing monitoring and supervision.[38] Also, jointly with the ECB and the other European Supervisory Authorities (the European Insurance and Occupational Pensions Authority (EIOPA) and the European Securities and Markets Authority (ESMA)), scenario analysis of the impact from the implementation of the EU transition package (Fit for 55) on the financial system.[39]

– European Central Bank (ECB): publication of research papers on the EU's green investment needs, the existing transition finance framework and policy proposals for increasing transition finance,[40] the intersection between climate transition policies and geoeconomic fragmentation[41] and the design of a macroprudential capital buffer for climate-related risks.[42]

26 NGFS, Transition Plan Package, 17.4.2024.
27 NGFS, Acute physical impacts from climate change and monetary policy, 29.8.2024.
28 NGFS, The green transition and the macroeconomy: a monetary policy perspective, 21.10.2024.
29 NGFS, Climate change, the macroeconomy and monetary policy, 29.10.2024.
30 NGFS, NGFS Conceptual Note on Adaptation, 13.11.2024.
31 NGFS, Sustainable and responsible investment in central banks' portfolio management – Practices and recommendations, 16.5.2024.
32 NGFS, Guide on climate-related disclosure for central banks – Second edition, 19.6.2024.
33 NGFS, Nature-related Financial Risks: a Conceptual Framework to guide Action by Central Banks and Supervisors, 2.7.2024.
34 NGFS, NGFS Climate Scenarios for central banks and supervisors – Phase V, 5.11.2024.
35 NGFS, Climate macroeconomic modelling handbook, 24.10.2024.
36 BIS, The role of climate scenario analysis in strengthening the management and supervision of climate-related financial risks, 16.4.2024.
37 EBA, Final Report: Guidelines on the management of ESG risks, 8.1.2025.
38 EBA, Report on greenwashing monitoring and supervision, 31.5.2024.
39 EBA, Transition risk losses alone unlikely to threaten EU financial stability, "Fit-For-55" climate stress test shows, 19.11.2024.
40 ECB (2025), "Investing in Europe's green future: green investment needs, outlook and obstacles to funding the gap", Occasional Paper No. 367, January.
41 ECB (2025), "The intersection between climate transition policies and geoeconomic fragmentation", Occasional Paper No. 366, January.
42 ECB (2024), "Designing a macroprudential capital buffer for climate-related risks", Working Paper No. 2943, May.

– European Insurance and Occupational Pensions Authority (EIOPA): jointly with the ECB, release of an EU-level proposal based on two pillars to reduce the insurance protection gap for natural catastrophe risks.[43]

– European Securities and Markets Authority (ESMA): jointly with the ECB and the other European Supervisory Authorities, publication of an opinion on the improvement of the Sustainable Finance Disclosure Regulation (SFDR).[44] Also, publication of guidelines on the enforcement of the European Corporate Sustainability Reporting Directive (CSRD) and public statement on the first application of the European Sustainability Reporting Standards (ESRS).[45]

– European Commission: agreement between the Council and the European Parliament on a new Regulation on environmental, social and governance (ESG) ratings.[46]

43 ECB/EIOPA, EIOPA and ECB propose European approach to reduce economic impact of natural catastrophes, 18.12.2024.
44 ESAs, ESAs propose improvements to the sustainable finance disclosure regulation, 18.6.2024. ESMA puts forward measures to support corporate sustainability reporting, 5.7.2024.
45 ESMA, ESMA puts forward measures to support corporate sustainability reporting, 5.7.2024.
46 European Commission, Environmental, social and governance (ESG) ratings: Council and Parliament reach agreement, 14.2.2024.

Box X.1

FINANCING CLIMATE CHANGE ADAPTATION AND THE ROLE OF CENTRAL BANKS AND SUPERVISORY AUTHORITIES

Climate change mitigation refers to actions aimed at limiting greenhouse gas emissions and preventing further increases in the planet's average temperature.[1] Climate change adaptation focuses on managing and reducing the adverse social, environmental and economic impacts caused by climate change. These impacts are expected to intensify as long as greenhouse gas concentrations in the atmosphere remain high and as environmental degradation and the climate crisis continue to escalate.[2]

Adaptation to climate change can yield multiple benefits. In particular, it helps reduce the losses associated with climate change, increases resilience and strengthens the capacity of society, the economy and the ecosystem to recover from extreme weather events. These benefits are often referred to as the "triple dividend" of resilience, which includes: (i) avoiding losses, (ii) stimulating economic activity and development, and (iii) delivering broader social and environmental co-benefits.[3] According to studies, investments in adaptation measures can yield substantial economic gains, especially over the long term. Notably, it is estimated that every US dollar invested in adaptation could generate up to USD 12 in total economic gains within this decade.[4]

Adaptation is not only necessary but also a legal obligation under European legislation. Specifically, the EU's Strategy on Adaptation to Climate Change, which was adopted in 2021,[5] aims to promote smarter, more systemic and swifter adaptation, while stepping up international action. This strategy complements the EU's mitigation efforts and its targets for climate neutrality by 2050. It is also fully aligned with the Paris Agreement and the European Climate Law.[6]

1 IPCC (2022), *Climate Change 2022: Mitigation of Climate Change* (see also FAQs).
2 IPCC (2022), *Climate Change 2022: Impacts, Adaptation and Vulnerability* (see also FAQs).
3 Tanner, T., S. Surminski, E. Wilkinson, R. Reid, J. Rentschler and S. Rajput (2015), *The Triple Dividend of Resilience: Realising development goals through the multiple benefits of disaster risk management*.
4 United Nations Office for Disaster Risk Reduction (UNDRR), Standard Chartered Bank and KPMG International (2024), "Guide for adaptation and resilience finance".
5 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, "Forging a climate-resilient Europe – the new EU Strategy on Adaptation to Climate Change", 24 February 2021.
6 *Questions and Answers: New EU strategy on adaptation to climate change*.

Additionally, at the national level, Greece's revised National Energy and Climate Plan (NECP) was approved in December 2024. The NECP serves as a strategic framework and a key tool for planning and implementing climate and energy policies. It outlines the country's priorities for adaptation to climate change and for transition to a sustainable energy system, while providing a detailed roadmap to achieve specific energy and climate targets by 2030, ultimately leading to climate neutrality by 2050. The NECP aims to ensure the social and environmental efficiency as well as the cost-effectiveness of policy measures by reducing energy costs, protecting consumers and enhancing the climate resilience of energy infrastructure, while also safeguarding the adaptability of the energy system to changing climate conditions.[7]

The analyses and reports of the Bank of Greece's Climate Change Impacts Study Committee (CCISC) consistently highlight the benefits of adaptation to climate change. As early as 2011,[8] the CCISC stressed the need for Greece to address the adverse effects of the climate crisis with timely actions – aimed not only at mitigating these effects but also at ensuring that key sectors of the economy, such as agriculture, tourism and infrastructure, adapt effectively to climate change.

Despite the growing need of adapting to climate change, adaptation finance remains disproportionately low compared to mitigation finance. It is estimated that in 2021-2022, only 5% of total global climate finance (USD 1.3 trillion) was allocated to adaptation.[9] Moreover, adaptation finance is predominantly sourced from public funds.[10] At the national level, Greece's climate adaptation efforts rely almost entirely on public resources, including European and national funding mechanisms, such as the Partnership Agreement for Regional Development (NSRF) 2021-2027, the Common Agricultural Policy (CAP) Strategic Plan 2023-2027, the Recovery and Resilience Facility (RRF), EU competitiveness programmes (notably Horizon and LIFE) and the Green Fund. A key initiative in this effort is the project "LIFE-IP AdaptInGR – Boosting the implementation of adaptation policy across Greece", which supports central government, regional and local authorities, research institutions and civil society in implementing the National Strategy for Adaptation to Climate Change.[11]

One reason explaining why climate adaptation financing remains low is the lack of adequate data to evaluate the costs and benefits of adaptation projects. Additionally, the complexity and specificity of financing needs for such projects, coupled with the absence of suitable financial instruments, likely reduce their appeal to investors.[12] Furthermore, recent actions by the newly elected US administration, which undermine global efforts to address climate change, could hinder international cooperation in securing the necessary financing for adaptation. In early 2025, the United States formally announced its withdrawal from the Paris Agreement and its intention to further invest in fossil fuels, while the Federal Reserve withdrew from the Network for Greening the Financial System (NGFS).[13] Moreover, several major US financial institutions pulled back from key international banking and investment initiatives, including the Net Zero Banking Alliance and the Net Zero Asset Managers initiative.

Studies indicate that insufficient adaptation to climate change could negatively impact, among other things, economic growth, price stability and financial stability, posing challenges for central banks and supervisory authorities. For instance, natural disasters may disrupt supply chains, damage infrastructure and increase inflation, while also reducing output and disposable income. In contrast, investment in adaptation and increased insurance coverage for natural catastrophe risks can deliver substantial benefits by mitigating the impacts of the climate

7 National Energy and Climate Plan – Revised Edition, Government Gazette B 6983/19.12.2024 (in Greek).
8 Climate Change Impacts Study Committee (CCISC) (2011), *The environmental, economic and social impacts of climate change in Greece*, Bank of Greece.
9 The remaining 95% of total global climate finance was allocated to climate change mitigation (91%) and to actions addressing both mitigation and adaptation (4%) (see "Global Landscape of Climate Finance 2023", Climate Policy Initiative).
10 Global Center on Adaptation and Climate Policy Initiative (2024), "State and Trends in Climate Adaptation Finance 2024".
11 IOBE (2023), "Climate change adaptation: Challenges and opportunities for the Greek economy" (in Greek).
12 NGFS (2024), "Conceptual Note on Adaptation".
13 Federal Reserve Board, press release, 17.1.2025

crisis, supporting faster recovery after disasters, easing fiscal burdens and strengthening the resilience of both the financial system and the wider economy.[14]

Central banks and supervisors can play a pivotal role, within their mandates, in supporting adaptation to climate change; however, the primary responsibility for addressing climate change and its impacts rests with governments. In the ECB's updated action plan on climate change and nature-related risks, adaptation is identified as an important area of research, particularly for analysing the economic impact of adaptation measures and the associated financing needs.[15] The NGFS has recently published the Conceptual Note on Adaptation, outlining the challenges of adaptation finance and the role of central banks and supervisors in climate change adaptation.[16] In particular, this publication highlights that central banks and supervisors can promote the adoption and implementation of enhanced risk management practices within the financial system, as well as support insurance uptake,[17] in order to strengthen economic resilience to the impacts of climate change. Four key areas of future actions are proposed for central banks and supervisors to address climate change adaptation: (i) developing metrics and tools to measure and disclose the impact of adaptation measures; (ii) incorporating these issues into the institutional and supervisory framework of the financial system; (iii) fostering conditions that encourage the financing of adaptation actions;[18] and (iv) collaborating with local, national and international bodies.

The Bank of Greece actively underscores the importance to strengthen the financing of climate change adaptation. Specifically, as a partner in the project "LIFE-IP AdaptInGR – Boosting the implementation of adaptation policy across Greece", it contributes to an initiative focused on mobilising resources for adaptation finance. As the Greek competent supervisory authority for insurance undertakings, the Bank of Greece is progressively incorporating climate change adaptation issues into its supervisory responsibilities and has consistently emphasised the critical role of private insurance in mitigating the effects of climate change and the necessity of reducing the insurance gap for natural catastrophes. In addition, the Bank of Greece participates in the Council for Private Insurance against Natural Disasters (Law 5116/2024).

There is a growing need to scale up adaptation finance, and the involvement of the financial system is crucial to this end. Mobilising private sector resources is of paramount importance, but it requires an enabling environment that encourages and supports the funding of adaptation projects. Against this background, central banks and supervisors are increasingly focused on enhancing the financing of climate change adaptation through a broad range of initiatives.

14 Mongelli, F.P., A. Ceglar and B.A. Scheid (2024), "Why do we need to strengthen climate adaptations? Scenarios and financial lines of defense", ECB Working Paper No. 3005.
15 "ECB steps up climate work with focus on green transition, climate and nature-related risks", press release, 30 January 2024.
16 NGFS (2024), "Conceptual Note on Adaptation".
17 ECB and EIOPA (2024), "Towards a European system for natural catastrophe risk management".
18 For example, through relevant research, data reporting on risks and opportunities related to climate change adaptation and the establishment of common standards, disclosure rules and an adaptation finance taxonomy.

Box X.2

SOCIAL IMPLICATIONS OF THE NEW EU EMISSIONS TRADING SYSTEM

The Emissions Trading Scheme (EU ETS),[1] introduced in 2005 by the European Union (EU), is central to reducing greenhouse gas (GHG) emissions and generating revenues to support the green transition and is therefore often referred to as the cornerstone of the EU's climate policy. The EU ETS applies to all EU Member

1 Directive 2003/87/EC of the European Parliament and of the Council.

States, as well as Iceland, Liechtenstein and Norway, and has been linked to the Swiss ETS since 2020. The system covers key sectors of the economy, such as electricity production, manufacturing, aviation and shipping, which together are responsible for around 40% of total EU emissions. Since its introduction in 2005,[2] the EU ETS has contributed to a 37.3% reduction in GHG emissions from these sectors.

The EU ETS operates on the "cap-and-trade" principle, establishing a ceiling on GHG emissions from key sectors of the economy. This limit corresponds to a fixed number of GHG emission allowances, each of which permits the holder to emit one tonne of carbon dioxide equivalent (CO_2eq). Allowance prices are set by the market through supply and demand, with two main mechanisms enhancing market stability: the Linear Reduction Factor (LRF) and the Market Stability Reserve (MSR).[3] The LRF sets the annual rate at which the cap is reduced, thereby contributing to the achievement of the EU's annual GHG emission reduction targets. The MSR stabilises the supply of GHG emission allowances in the market, absorbing surplus allowances during periods of oversupply and releasing additional allowances when demand exceeds supply, thus helping to stabilise prices within desired limits.

As climate change is a global issue, the risk of "carbon leakage" could significantly undermine global climate efforts. Specifically, European companies may relocate their operations to countries with looser environmental standards, or carbon-intensive products may be imported from third countries, replacing European-made goods. To address carbon leakage and ensure fair carbon pricing for goods produced outside the EU, the Carbon Border Adjustment Mechanism (CBAM) was introduced as a complement to the EU ETS. Scheduled to become fully operational by 2026, the CBAM will equalise the carbon costs between EU products and imported goods, ensuring that the EU's climate objectives are not compromised by the relocation of production to countries with less stringent climate policies.

As part of the EU's efforts to achieve the GHG reduction targets outlined in the European Green Deal,[4] a new Emissions Trading System (EU ETS2) was introduced in 2023, scheduled for full implementation by 2027.[5] This new system builds on the existing framework by extending coverage to sectors such as building heating, construction and road transport, which are major "polluters" in the EU, accounting for approximately one-third of its total emissions.[6]

The full economic and social impacts of the EU ETS2 remain uncertain, as inflation and economic growth are likely to be affected in the coming years,[7] depending however on multiple factors. National green discretionary fiscal measures, particularly those related to carbon pricing and energy taxes, are expected to increase inflation by approximately 0.2 percentage points (pp) in 2025 and by 0.1 pp in 2026, with their impact coming close to zero in 2027. Moreover, these measures are expected to dampen real GDP growth by 0.05 pp in 2025 and by 0.1 pp in 2026 and 2027. In particular, upstream producers will need to pay for emissions from their products, and the costs are likely to be passed on to consumers. Vulnerable groups[8] and consumers, who spend a large share of their income on energy and transport or lack access to affordable alternatives, are at risk of being disproportionately affected by carbon price volatility. These impacts may be stronger in geographically isolated communities, such as islands, rural and mountainous areas, or in remote and less developed regions.

In this context, unless effective social protection mechanisms are put in place and revenues from GHG emissions trading are redistributed, significant pressures on heating and transport costs may arise. Measures to mitigate and adapt to climate change, along with each country's energy mix – which shapes energy production costs – will play a key role in this regard. Economies experiencing delayed energy transitions and a strong reliance on lignite reserves or other fossil fuels may be more vulnerable to the risks associated with rising carbon pricing.

2 European Commission, Report on the functioning of the European carbon market in 2022.
3 European Commission, Market Stability Reserve.
4 European Commission, The European Green Deal.
5 European Commission, ETS2: buildings, road transport and additional sectors.
6 LIFE ETX (2024), EU ETS 101 – A beginner's guide to the EU's Emissions Trading System.
7 ECB, "Eurosystem staff macroeconomic projections for the euro area, December 2024".
8 WWF (2022), SCF and ETS2 impact studies.

To address the social impacts of the EU ETS2 and ensure a fair transition to climate neutrality, EU Member States have established the Social Climate Fund.[9] This Fund provides financial assistance enabling Member States to support the green transition of vulnerable groups affected by "energy and transport poverty," such as micro-enterprises, transport users and households.[10] The Fund's revenues will be used, *inter alia*, to improve buildings' energy efficiency, support the decarbonisation of buildings' heating and cooling, including through the integration of renewable energy generation and storage, and enhance access to zero- and low-emission mobility and transport solutions.

Each Member State is invited to submit a Social Climate Plan to the European Commission by June 2025, setting out a coherent package of existing or new national measures and investments aimed at addressing the social implications of climate change. To support Member States in developing their plans, the European Commission has launched a dedicated initiative under the Technical Support Instrument.[11] Funding from the Social Climate Fund will be disbursed once Member States meet the milestones and targets set out in their approved plans. National authorities responsible for preparing the plans have been designated by each Member State, so as to facilitate the Fund's operation;[12] in Greece, the Ministry of Environment and Energy has been appointed as the competent authority.

The Fund is expected to mobilise approximately EUR 65 billion from the auctioning of emission allowances under the new EU ETS2 for the period 2026-2032.[13] An additional EUR 50 million in allowances will be made available from the current EU ETS. Member States will be required to contribute at least 25% of the estimated total cost of their Social Climate Plans. In total, the Fund's budget for the 2026-2032 period is expected to reach no less than EUR 86.7 billion.

As an evolution of the EU ETS, the EU ETS2 is poised to become a driving force in the EU's transition to a low-carbon, sustainable economy. While the system has proven effective in reducing emissions, its extension to sectors with direct social impacts presents a new, complex challenge. To ensure a smooth transition, it is crucial for Member States to closely monitor carbon price developments, assess the economic and social costs and take appropriate preventive and mitigating measures. The implementation of transition plans towards climate neutrality, together with the adoption of sustainable practices and energy-efficiency measures, will enhance economic resilience and mitigate climate change impacts.

9 Regulation (EU) 2023/ 995 of the European Parliament and of the Council.
10 European Commission, Social Climate Fund.
11 European Commission, 2024 Flagship Technical Support Project.
12 European Commission, List of Member States authorities responsible for the preparation of the Social Climate Plans.
13 European Commission, Social Climate Fund: Structural set-up of the programme.

2 GREENHOUSE GAS EMISSIONS IN THE EU AND IN GREECE

Total greenhouse gas emissions in the EU-27 (including "land use, land use changes and forestry" and indirect CO_2 emissions) decreased by 2.6% in 2022 (-83.3 million tonnes of CO_2 equivalent ($MtCO_2e$)) compared to 2021, reaching 3,132.7 $MtCO_2e$ (see Table X.1). The largest decline was observed in the buildings sector (residential and retail properties) and is mainly attributed to lower consumption of natural gas compared with one year earlier. According to the Copernicus Climate Change Service, 2022 was the second warmest year on record in Europe. Relative to 1990, total greenhouse gas emissions in the EU-27 dropped by 32.6% in 2022 (-1,516.3 $MtCO_2e$). The downward course over this 32-year period is attributed to a number of factors, including the increasing share of renewable energy in the overall energy mix; the use of less carbon-intensive fossil fuels; improvements in energy efficiency, e.g. due to better insulation standards in buildings; structural changes in the economy, with a higher share of services in total GDP; the economic recession during the COVID-19 pandemic; and high

Table X.1 Greenhouse gas emissions[1]

(in million tonnes of CO_2 equivalent)

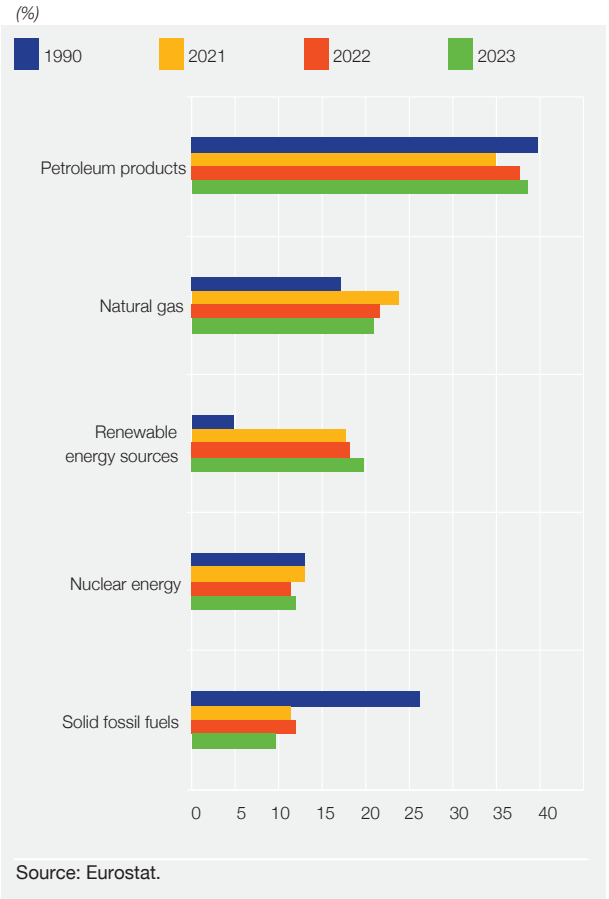
Country	1990 ($MtCO_2e$)	2022	Change 2021-2022 (percentage changes)	Change 2022-2023	Change 1990-2022	Change 1990-2023
Austria	67.4	68.4	3.1	-6.8	1.4	-5.5
Belgium	142.9	103.1	-6.1	-4.2	-27.8	-30.8
Bulgaria	81.0	48.9	10.0	-27.4	-39.7	-56.3
Croatia	25.2	19.7	5.4	-8.5	-21.9	-28.5
Cyprus	5.4	8.5	-0.1	0.3	56.3	56.8
Czech Republic	192.5	121.1	-3.9	-13.2	-37.1	-45.4
Denmark	78.3	41.7	-4.8	-5.7	-46.8	-49.8
Estonia	35.0	14.3	6.7	-18.6	-59.2	-66.8
Finland	48.2	50.1	-1.8	-21.7	4.1	-18.4
France	521.2	377.2	-3.9	-6.6	-27.6	-32.4
Germany	1,283.4	754.3	-1.0	-10.2	-41.2	-47.2
Greece	101.7	72.9	-0.1	-9.5	-28.3	-35.1
Hungary	91.8	52.7	-6.7	-9.5	-42.5	-47.9
Ireland	60.2	64.6	-2.7	-6.1	7.2	0.6
Italy	518.7	391.8	1.4	-7.4	-24.5	-30.5
Latvia	13.7	15.1	16.4	-16.3	10.3	-7.7
Lithuania	42.7	12.6	-14.5	-2.8	-70.6	-71.4
Luxembourg	12.7	7.5	-14.0	-7.0	-40.8	-44.9
Malta	2.6	2.3	7.8	-5.8	-13.5	-18.5
Netherlands	228.1	158.4	-7.6	-7.3	-30.5	-35.6
Poland	447.4	344.9	-8.1	-8.2	-22.9	-29.2
Portugal	66.1	50.5	0.3	-7.6	-23.7	-29.5
Romania	230.4	63.5	-5.7	-7.1	-72.4	-74.5
Slovakia	64.6	29.8	-12.3	-2.4	-53.8	-54.9
Slovenia	14.4	15.4	-1.9	-6.4	7.1	0.2
Spain	253.4	246.8	2.4	-7.6	-2.6	-10.0
Sweden	19.9	-3.4	-215.7	-25.6	-117.2	-84.9
EU-27	**4,649.0**	**3,132.7**	**-2.6**	**-8.8**	**-32.6**	**-38,4**

Sources: European Environment Agency, "Annual European Union greenhouse gas inventory 1990-2022 and inventory document 2024", December 2024. For 2023: European Environment Agency, "Approximated EU greenhouse gas inventory-Proxy GHG emission estimates for 2023", ETC CM Report 2024/06, October 2024.
1 Total GHG emissions, including land use, land use changes and forestry, and international aviation.

energy prices in 2022.[47] The largest decreases in pollutants[48] were observed in the sectors of energy production, in manufacturing and construction, including combustion emissions from iron and steel production, as well as in the buildings sector (-498, -370 and -222 $MtCO_2e$, respectively). Conversely, an increase in emissions resulted from road transport, refrigeration and air conditioning, forest land, due to the ageing of forests since the late 2000s and a lower annual increment, as well as increased harvesting (+147, +54 and +40 $MtCO_2e$, respectively).

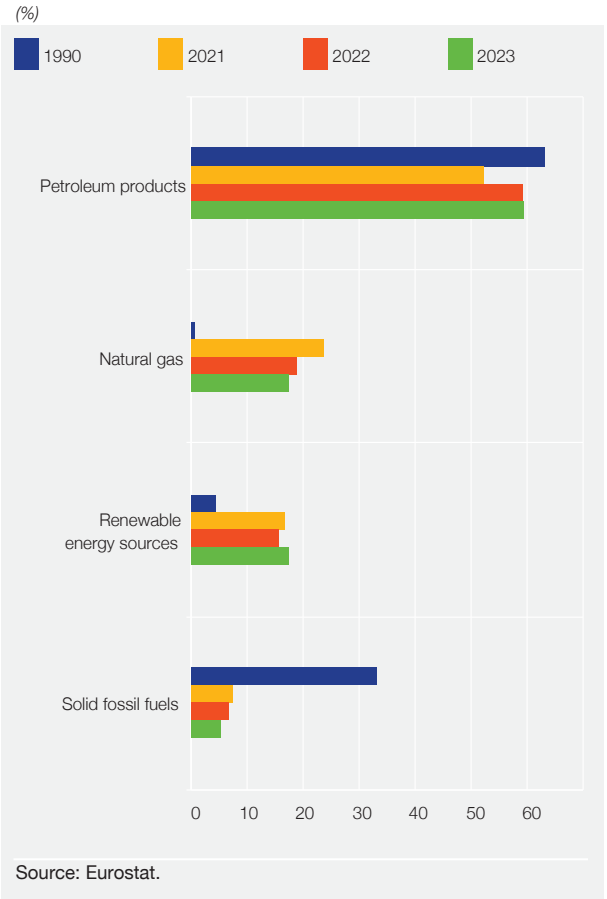
47 European Environment Agency, "Annual European Union greenhouse gas inventory 1990-2022 and inventory document 2024", December 2024.
48 European Environment Agency, op. cit.

Chart X.1 Shares of energy products in total available energy in the EU-27



Source: Eurostat.

Chart X.2 Shares of energy products in total available energy in Greece



Source: Eurostat.

In 2022, almost all EU-27 Member States reduced emissions relative to 1990, thus contributing to the positive performance of the EU as a whole. Germany, Romania, Italy and France accounted for about two-thirds of the overall emissions reduction in the EU over the past 32 years. Certain policies, both in the EU and in individual Member States, have contributed to the overall reduction in greenhouse gas emissions, such as key agricultural and environmental policies in the 1990s and climate and energy policies since 2005. Specifically, the main factors behind the significant emissions reduction in Germany were increased efficiency of heating systems and economic restructuring, particularly in the iron and steel sector. Other important factors were a switch from coal to natural gas, a strong increase in the use of renewable energy sources (RES) and waste management measures. Emissions in France were below 1990 levels, reflecting drastic reductions in N_2O emissions in the chemical industry, while lower emissions in Italy are due to a contraction in industrial production. As regards Poland and other Member States, the main drivers of the drop in emissions were a shrinking of the energy-inefficient heavy industry sector and the overall restructuring of the economy towards services. In general, common factors that supported the reduction in greenhouse gas emissions in most EU-27 countries over the past 32 years, excluding the short-term impacts of the pandemic-related economic downturn, were the use of less carbon-intensive fuels due to the switch from coal to natural gas, a considerable increase in the use of RES, as well as significant improvements in energy efficiency. In 2022, the largest emitters in the EU-27 were Germany (24.1%), Italy (12.5%) and France (12.0%), followed by Poland (11.0%) and Spain (7.9%).

The downward trend in greenhouse gas emissions continued in 2023 as well, with an estimated drop of -8.8% relative to 2022 (-38.4% relative to 1990), while 26 EU Member States reduced

pollutants (the only exception being Cyprus, where emissions remained unchanged). However, the regional breakdown of changes differs significantly across Member States. Specifically, the greatest emissions reduction, in absolute terms, in 2023 compared to 2022 was observed in Germany, where emissions decreased by 76.8 $MtCO_2e$. High emissions reductions were also recorded in Italy and in Poland (-28.6 and -28.1 $MtCO_2e$, respectively).[49] In annual terms, the highest reductions were recorded in Bulgaria (-27.4%) and in Sweden (-25.6%).[50]

In the EU-27, the most important greenhouse gas is CO_2, which accounted for 79.2% of total emissions in 2022, including "land use, land use changes and forestry". In particular, CO_2 emissions in 2022 were 2,481 million tonnes, 32% below 1990 levels. Methane (CH_4) and nitrogen oxide (N_2O) emissions also declined considerably relative to 1990. By contrast, hydrofluorocarbon (HFC) emissions were higher than in 1990, but significant decreases have been reported over the past years. As regards the emissions breakdown by source of origin, the biggest contributor is energy (77% of total EU-27 emissions in 2022), followed by agriculture and industrial processes with 11% and 9%, respectively.[51]

A breakdown of the energy mix in both the EU-27 and Greece in 2023 compared to 1990 highlights the considerable progress achieved in RES penetration, with a concomitant decrease in the share of fossil fuels in total energy. Specifically, in 2023, according to Eurostat data, the energy mix in the EU-27 (see Chart X.1) consisted mainly of five different sources: petroleum products, including crude oil (37.7% of total available energy, from 39.0% in 1990), natural gas (20.4%, from 16.8% in 1990), RES (19.5%, from 4.8% in 1990), nuclear energy (11.8%, from 12.7% in 1990) and solid fossil fuels (9.4%, from 25.7% in 1990). As far as Greece is concerned (see Chart X.2), the respective shares were 58.5% for petroleum products (1990: 62.1%), 17.3% for natural gas (1990: 0.6%), 17.2% for RES (1990: 4.5%) and 5.1% for solid fossil fuels (1990: 32.6%).

49 European Environment Agency, "Approximated EU greenhouse gas inventory – Proxy GHG emission estimates for 2023", ETC CM Report 2024/06, October 2024.

50 In Greece, the decrease in emissions primarily resulted from energy-related activities. Higher living standards owing to economic growth, the significant expansion of the services sector, as well as the introduction of natural gas and the increased share of RES in the Greek energy system, constitute the key factors behind the reduction of emissions. Moreover, the large drop observed in 2023 can be mainly attributed to the limited operation of lignite-fired plants, which were replaced with a higher share of natural gas and RES than in past years.

51 In Greece, in 2022, greenhouse gas emissions from energy accounted for 67.9% of total emissions, down by almost 29.4% compared to 1990 levels. Respectively, emissions from industrial processes accounted for 12.3% and declined by 11.8%, while emissions from agriculture, with a share of 10.2%, decreased by almost 24.2% between 1990 and 2022. Conversely, emissions from the waste management sector, accounting for 7.9% of total emissions in 2022, rose by almost 15.9% against 1990 (Ministry of Environment and Energy, *National inventory report of Greece for greenhouse and other gases for the years 1990-2022*, December 2024).