# X ENVIRONMENT, ENERGY AND CLIMATE CHANGE

In 2021, global greenhouse gas emissions (GHG) increased again after a temporary decline in 2020. The average global temperature was one of the warmest on record, and extreme weather events became more frequent and intense. Encouraging developments included the adoption of policies, notably in the EU, to promote green recovery and transition to low carbon economies, while the outcomes of the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP26) were seen as positive but insufficient steps forward. A hotly debated issue among Member States was the proposed inclusion, on a transitional basis and subject to strict conditions, of nuclear energy and gas in the EU Taxonomy of Sustainable Finance. The Bank of Greece established a Centre for Climate Change and Sustainability, actively supports the goals of the Paris Agreement and, together with the Climate Change Impacts Study Committee (CCISC), takes part in several national and international initiatives on sustainable development and climate change.

Developments continue to confirm the urgent need to drastically tackle climate change, one prerequisite for which is global cooperation. This is also highlighted by the increasingly stark warnings from international organisations and the scientific community about the health, environmental and financial risks of climate change, calling, among other things, for action to address climate change and biodiversity loss together. Equally important is progress in the necessary technologies, and it is encouraging that the past twelve months have seen significant advances in research, particularly in the areas of clean energy sources (nuclear fusion, green hydrogen, etc.), energy storage and carbon dioxide removal. In the new geopolitical conditions that have emerged following Russia's invasion of Ukraine, it is becoming all the more pressing to accelerate a more widespread take-up of clean energy.

# 1 CLIMATE CHANGE AND ENERGY: INTERNATIONAL DEVELOPMENTS AND POLICIES, KEY SCIENTIFIC FINDINGS AND REPORTS<sup>1</sup>

In 2021, global carbon dioxide emissions increased by an estimated 4.9%, following a decline of 5.4% in 2020; the 2021 drop is attributed to the relaxation of COVID-19 restrictions on economic activity.<sup>2</sup> The average global temperature was the sixth highest since 1880<sup>3</sup> and more than 1°C above pre-industrial levels, while the past twelve months have been marked by repeated weather extremes.<sup>4</sup> Moreover, the term "climate crisis" has become much more common in domestic and international media (see Box X.1).

In 2021, green recovery featured high on the policy agenda, as part of the efforts to overcome the economic fallout of the pandemic in a way that is consistent with sustainability. At

<sup>1</sup> The cut-off date for information and data in this Chapter is 28 March 2022.

<sup>2</sup> See Global Carbon Budget 2021, 4.11.2021, https://www.globalcarbonproject.org/carbonbudget/archive/2021/GCP\_Carbon-Budget\_2021.pdf.

<sup>3</sup> NOAA/NCEI, "Assessing the Global Climate in 2021", 13.1.2022.

<sup>4</sup> Examples include: very low temperatures in the US states of Texas and New Mexico in February and March 2021; a record heat wave in western Canada in June and July; deadly floods in Germany and Belgium in July; devastating wildfires in Greece, Turkey, Spain and California in August; continued warming and ice melt in the Arctic; and unprecedented windstorms and floods in the UK and Australia, respectively, in February and March this year. See also World Weather Attribution, "Heavy rainfall which led to severe flooding in Western Europe made more likely by climate change", 23.8.2021; and NOAA, "Arctic Report Card – Update for 2021", 6.12.2021.

least at the EU level, developments were generally positive, as Member States drew up and started to implement national Recovery and Resilience plans, benefiting from Next Generation EU (NGEU) funding, one focus of which is on green transition projects. Still, there is much to be done by the largest economies in the world towards effective green recovery policies.<sup>5</sup>

Decarbonisation is crucial for a green recovery and green transition in general. It is worth noting that, in May 2021, major multinational oil companies faced shareholder pressure to become greener. However, according to a recent report, the net zero-emission plans of some major companies in various sectors were assessed as ineffective.<sup>6</sup> In the EU, following the Taxonomy Regulation 2020/852, Commission Delegated Regulation (EU) 2021/2139 was adopted in June 2021, concerning the determination of environmentally sustainable economic activities in some energy sectors. Also, on 2 February 2022, following a contentious debate among the governments of EU Member States, the European Commission published a draft Complementary Climate Delegated Act to accelerate decarbonisation,<sup>7</sup> incorporating –on a transitional basis and under strict conditions- specific nuclear energy and natural gas activities into the list of economic activities covered by the EU Taxonomy. Regarding natural gas, the draft Act's proposed technical screening criteria and a 270gr CO<sub>2</sub>/KWh direct GHG emissions threshold<sup>8</sup> could effectively exclude several natural gas-fired electricity generation facilities from the Taxonomy. Before its entry into force, the Act will need to be formally approved by the EU Council and the European Parliament. It has already come under heavy fire from environmental groups and other organisations,<sup>9</sup> while experts are split between those who warn against the hazards of nuclear energy or argue that natural gas is not clean and those who see the use of these two energy sources as an inevitable until the renewable energy market matures and technology makes sufficient headway in the development of alternative energy sources (green hydrogen, nuclear fusion, etc.), as well as in energy storage and carbon capture and removal.

Moreover, the new geopolitical conditions that have emerged following Russia's invasion of Ukraine are already affecting national energy policies. Germany was the first to emphasise the importance of energy autonomy: in his policy statement addressing the German Bundestag on 27 February 2022, Chancellor Olaf Scholz announced (a) measures to increase the amount of natural gas in storage to two billion cubic metres; and (b) the rapid construction of two liquefied natural gas (LNG) import terminals, which could also handle green hydrogen in the future. Soon afterwards, the United States and the United Kingdom announced an embargo on Russian oil and gas, while, the informal EU summit of 10-11 March 2022 set out guidelines to phase out dependency on Russian gas, oil and coal imports. These included, in particular: diversifying supplies and routes, including through liquefied natural gas and biogas; further developing an EU hydrogen market and accelerating the development of renewables; improving the interconnection of European electricity and gas networks; improving energy efficiency and promoting circularity; and raising storage capacity. On 24-25 March, the European Council decided that Member States would work together on voluntary common

<sup>5</sup> See UN Environment Programme (UNEP) press release, "Are we on track for a green recovery? Not Yet", 10.3.2021, on the report "Are We Building Back Better? Evidence from 2020 and Pathways for Inclusive Green Recovery Spending".

<sup>6</sup> NewClimate Institute, Corporate Climate Responsibility Monitor 2022, 6.2.2022.

<sup>7</sup> See European Commission press release, "EU Taxonomy: Complementary Climate Delegated Act", 2.2.2022.

<sup>8</sup> The 270g CO<sub>2</sub>e/kWh threshold for new electricity generation facilities is much lower than called for by Member States (cf. the threshold of 340g CO<sub>2</sub>e/kWh proposed by France or a 380g CO<sub>2</sub>e/kWh supported by 80 MEPs from four political groups). On the Greek side, feedback on the draft Delegated Act was provided by the Ministry of Environment and Energy and industry stakeholders, including the Hellenic Association of Independent Power Producers.

<sup>9</sup> It is worth noting that the inclusion of gas in the Taxonomy was strongly criticised by the Institutional Investors Group for Climate Change (IIGCC) in its open letter of 12 January 2022. See https://www.iigcc.org/news/iigcc-publishes-open-letter-calling-forgas-to-be-excluded-from-the-eu-taxonomy.

purchase of gas, LNG and hydrogen, while also inviting Member States to start the refilling of gas storage ahead of next winter and to complete and improve gas and electricity interconnections throughout the EU.<sup>10</sup>

During 2021, significant policy and legislative actions to advance the goals of the Paris Agreement included the following:

– On 22 April 2021, the United States convened a virtual Leaders Summit on Climate, bringing together 40 world leaders, at which President Biden pledged to cut US emissions by 50% by 2030.

– On 6 July 2021, the European Commission adopted a number of measures to boost sustainable finance. These included the new Sustainable Finance Strategy; a proposal for a Regulation on a European Green Bond Standard (see Box X.2); and a Taxonomy Disclosures Delegated Act, concerning the information to be disclosed by firms about the proportion of their EU Taxonomy-aligned activities.<sup>11</sup> (See also Box X.4 for a discussion of the interactions between sustainable development, sustainable finance and digital financial technology.)

– On 8 July 2021, following the conclusion of its monetary policy strategy review, the ECB announced an ambitious action plan to include climate change considerations in its monetary policy strategy.<sup>12</sup> The plan aims to ensure that, in the fulfilment of its monetary policy mandate, the Eurosystem takes into account the economic impact of climate change, as well as the implications of low-carbon transition policies. It comprises measures that strengthen and broaden ongoing initiatives by the Eurosystem to better account for climate change considerations with the aim of preparing the ground for changes to the monetary policy implementation framework.

– On 14 July 2021, the European Commission announced a set of measures (the "Fit for 55" package) to reduce net GHG emissions by 55% by 2030.<sup>13</sup>

– On 27 October 2021, the European Commission adopted a review of EU banking rules (the Capital Requirements Regulation and the Capital Requirements Directive), aimed to support the transition to climate neutrality and make banks more resilient to environmental, social and governance (ESG) risks.<sup>14</sup>

– On 1 November 2021, the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 26) concluded with the adoption of the Glasgow Climate Pact,<sup>15</sup> whereby countries reaffirmed their commitment to take action. UN Secretary-General António Guterres acknowledged that important steps forward had been taken, but cautioned that we are still knocking on the door of climate catastrophe.<sup>16</sup>

<sup>10</sup> See https://www.bundesregierung.de/breg-en/news/policy-statement-by-olaf-scholz-chancellor-of-the-federal-republic-of-germany-and-member-of-the-german-bundestag-27-february-2022-in-berlin-2008378; https://www.consilium.europa.eu/media/ 54773/20220311-versailles-declaration-en.pdf; and European Council Conclusions, 24-25 March 2022.

<sup>11</sup> See European Commission press release, 6.7.2021.

<sup>12</sup> See ECB press release, 8.7.2021.

<sup>13</sup> See European Commission press release, "European Green Deal: Commission proposes transformation of EU economy and society to meet climate ambitions", 14.7.2021. See also European Commission Communication, "Fit for 55 – delivering the EU's 2030 climate target on the way to climate neutrality".

<sup>14</sup> See European Commission press release, "Banking Package 2021: new EU rules to strengthen banks' resilience and better prepare for the future", 27.10.2021.

<sup>15</sup> https://unfccc.int/sites/default/files/resource/cma2021\_10\_add1\_adv.pdf. Another important document issued during the conference was the Coalition of Finance Ministers for Climate Action and NGFS Chairs Joint COP26 Statement.

<sup>16</sup> Secretary-General's statement on the conclusion of the UN Climate Change Conference COP26, 13.11.2021, https://www.un.org/sg/en/node/260645.

– Lastly, on 27 January 2022, the United States convened a virtual ministerial meeting of the Major Economies Forum on Energy and Climate, which stressed the need to strengthen climate ambition, accelerate efforts to tackle the climate crisis and reduce methane emissions.

Over the past twelve months, reports by international organisations and research studies continued to focus on:

(a) the need for timely and decisive action to meet the goals of the Paris Agreement and reduce GHG emissions to net zero by 2050 (two reports by the UN Intergovernmental Panel on Climate Change (IPCC),<sup>17</sup> three reports by the International Energy Agency (IEA),<sup>18</sup> one report by the UN Environment Programme (UNEP)<sup>19</sup> and one by the Energy Transitions Commission (ETC)<sup>20</sup>);

(b) the risks of climate change for human health, the environment and biodiversity;<sup>21</sup>

(c) the risks for the financial system (see reports by the ECB and the ESRB;<sup>22</sup> the Joint NGFS-INSPIRE Study Group on Biodiversity and Financial Stability;<sup>23</sup> the LSE research centres and the London University;<sup>24</sup> and the WWF<sup>25</sup> – see also Box X.3 in this chapter);

(d) the need to address climate change and biodiversity issues together;<sup>26</sup>

(e) research into clean energy sources (green hydrogen, nuclear fusion);27

(f) research in the area of energy storage;28 and

(g) effective ways to raise public awareness of climate change risks and policies.<sup>29</sup>

- 17 IPCC, (a) Climate Change 2021: The Physical Science Basis Contribution of Working Group I to the Sixth Assessment Report of the IPCC, 9.8.2021; and (b) Climate Change 2022: Impacts, Adaptation and Vulnerability – Working Group II Sixth Assessment Report – Summary for Policymakers, 27.2.2022, https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC\_AR6\_ WGII\_SummaryForPolicymakers.pdf.
- 18 IEA, (a) Global Energy Review 2021 Assessing the effects of economic recoveries on global energy demand and CO<sub>2</sub> emissions in 2021, April 2021; (b) Net Zero by 2050: a Roadmap for the Global Energy Sector, May 2021 (see also the accompanying IEA press release, "Pathway to critical and formidable goal of net-zero emissions by 2050 is narrow but brings huge benefits, according to IEA special report", 18.5.2021); and (c) World Energy Outlook 2021, 13.10.2021.
- 19 UNEP, Emissions Gap Report 2021 The Heat Is On, 26.10.2021.
- 20 Energy Transitions Commission, Keeping 1.5°C Alive: Closing the Gap in the 2020s, September 2021.
- 21 See Daniel R. Bressler, "The mortality cost of carbon", Nature Communications, 29.7.2021; Wim Thiery et al., "Intergenerational inequities in exposure to climate extremes", Science, 26.9.2021; Global Coal Reef Monitoring Network (GCRMN), Rising Sea Surface Temperatures Driving the Loss of 14 Percent of Corals Since 2009; Some Show Resilience, Offering Hope for Recovery, 5.10.2021; and (US) National Academies, Biodiversity at Risk – Today's Choices Matter, Consensus Study Report 2022.
- 22 See ECB/ESRB, *Climate-related risk and financial stability*, July 2021; and ECB, "ECB economy-wide climate stress test Methodology and results", Occasional Paper Series, No. 281, September 2021.
- 23 See Joint NGFS-INSPIRE Study Group on Biodiversity and Financial Stability, *Biodiversity and Financial Stability: building the case for action*, October 2021. The project benefited from the contribution of the Bank of Greece.

24 Climate-neutral central banking: How the European System of Central Banks can support the transition to net-zero, May 2021.

- 25 WWF, Nature's next stewards: why central bankers need to take action on biodiversity loss, July 2021. The publication includes the public responses of the Bank of Greece and other central banks.
- 26 IPBES and IPPC, Biodiversity and Climate Change, June 2021.
- 27 Regarding green hydrogen, see: European Parliamentary Research Service Briefing, EU hydrogen policy: Hydrogen as an energy carrier for a climate-neutral economy, April 2021; and International Renewable Energy Agency (IRENA), Geopolitics of the Energy Transformation The Hydrogen Factor, January 2022. For nuclear fusion, see: Zylstra, A.B. et al., "Burning plasma achieved in inertial fusion", Nature, January 2022; and UK Atomic Energy Authority (UKAEA) press release, "Fusion Energy Record Demonstrates Power Plant Future", 9.2.2022.
- 28 In January and February 2022, the Boston University Institute for Sustainable Energy held a series of four virtual workshops entitled "Where Is Energy Storage Headed?", which brought together leading experts in the field. See https://www.bu.edu/igs/2022/01/04/workshop-series-where-is-energy-storage-headed/.
- 29 See e.g. Bernard, R., P. Tzamourani and M. Weber, "Climate change and individual behaviour", Deutsche Bundesbank Discussion Paper No. 01/2022.

From the perspective of central banks and supervisors, 2021 saw the publication of important analyses regarding the incorporation of climate change and sustainability considerations into financial regulation and supervision. A brief overview is provided below:

– Network of Central Banks and Supervisors for Greening the Financial System (NGFS): Reports on: the progress made by supervisors in integrating climate-related and environmental risks into their supervisory frameworks; global climate scenario exercises and new climate scenarios for central banks and supervisors; biodiversity-related financial risks; and bridging data gaps;

 Basel Committee on Banking Supervision (BCBS): Principles for the effective management and supervision of climate-related financial risks; report on climate-related risk drivers and their transmission channels; and report on climate-related financial risk measurement methodologies;

– European Banking Authority (EBA): Draft implementing technical standards on prudential disclosures on ESG risks; report on management and supervision of ESG risks for financial institutions and investment firms; and draft joint (EBA/EIOPA/ESMA) regulatory technical standards on disclosures under the Sustainable Finance Disclosure Regulation (SFDR);

 Single Supervisory Mechanism (SSM): Report on the supervisory review of banks' approaches to manage climate and environmental risks; and announcement and results of economy-wide climate stress test;

– European Insurance and Occupational Pensions Authority (EIOPA): Sustainable Finance Roadmap 2022-2024; opinion on the supervision of the use of climate change risk scenarios in ORSA; consultation on application guidance on running climate change materiality assessment and using climate change scenarios in the ORSA; report on non-life underwriting and pricing in light of climate change; discussion paper on methodology on potential inclusion of climate change in the Nat Cat standard formula; and article on climate change, catastrophes and the macroeconomic benefits of insurance;

– European Securities and Markets Authority (ESMA): Preliminary report – Emission Allowances and derivatives thereof; letter to the European Commission on the challenges in the area of ESG ratings; and letter to the European Commission on priority issues relating to SFDR application.

### Box X.1

# FROM GLOBAL WARMING TO CLIMATE CRISIS: REVIEWING THE TERMINOLOGY OF CLIMATE CHANGE

Several different terms have been used to describe climate change and its impact on the planet. The terms that have made their way into our everyday vocabulary are "global warming" and "climate change". Other terms used less frequently and emphatically include climate catastrophe, climate disruption, climate chaos, ecological breakdown, climate deregulation, climate war, global heating and climate apocalypse. Advocacy groups, media organisations, local governments (including in Australia), UN institutions and the UK parliament are shifting their language on climate change to become more powerful and emotive. Conventional terminology is being superseded by expressions such as climate emergency, climate crisis and climate breakdown, which are seen as more accurately describing what is happening around us.<sup>1</sup> However, of all the above-mentioned new terms, the one we come across and listen more often today is "climate crisis".

<sup>1</sup> Bedi, G. (2020), "Is it time to rethink our language on climate change?", Lens, Monash University (https://lens.monash.edu/ @environment/2020/01/03/1379384/is-it-time-to-rethink-our-language-on-climate-change).

#### **Global warming**

19th century scientists Jean-Baptiste Fourier, Eunice Foote and John Tyndall were the first to investigate the role of greenhouse gases in warming the Earth's surface.<sup>2</sup> Nobel Laureate Svante Arrhenius continued their work, claiming in 1897 that the burning of fossil fuels may lead to global warming. His calculations led him to the conclusion that, as a result of human activity, carbon dioxide is added to the atmosphere, which could increase the Earth's temperature.<sup>3</sup> At that time, however, human influences were considered insignificant and the oceans were considered to be large "carbon sinks", automatically eliminating pollution. As a result, his warning went unheard and the matter was forgotten until 1975, when the scientific study by Wallace Broecker was published, using for the first time the term "global warming".<sup>4</sup>

In the late 1980s, the issue of global warming came to the fore in politics and the media, as the average annual temperature rose sharply. Global warming became the dominant popular term in June 1988, when NASA scientist James Hansen testified to Congress that "global warming has reached a level such that we can ascribe with a high degree of confidence a cause and effect relationship between the greenhouse effect and the observed warming".<sup>5</sup> His testimony received broad coverage in the US media, making the term very popular.<sup>6</sup> Also worldwide, global warming became a daily topic in the news, in an effort to communicate that the planet is experiencing a change in climate due to global warming.

The term "global warming" was formalised in the 1980s to describe the impact on the earth's surface temperature from the increased level of heat-trapping gasses in the atmosphere. However, when discussions about global warming intensified and moved from the scientific realm to the public arena, it was seen that it was not a helpful description and decades later the term "climate change" prevailed among scientists, politicians and their institutions.<sup>7</sup> The term "climate change" has become more common as it reflects the long-term change in the Earth's climate. However, the term "global warming" remains valuable and is commonly used by scientists and the public, as it is a straightforward and accurate description of what is happening in global temperatures over time.<sup>8</sup>

#### Climate change

By the time of Hansen's testimony, international organisations had paved the way for "climate change" to eventually become the most popular term. The World Meteorological Organisation and the United Nations Environment Programme established in 1988 the Intergovernmental Panel on Climate Change (IPCC), which in 1992 published the UN Framework Convention on Climate Change.<sup>9</sup> According to Article 1 thereof, "climate change means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere". The term "global warming" is not used in the Framework Convention. These events were milestones for the universal prevalence and use of the term "climate change" in the years that followed.

In 2002, Frank Luntz, a political consultant, advised Republicans to start using the term "climate change" as it suggests a more controllable and less emotional challenge, while "global warming" has catastrophic connotations attached to it.<sup>10</sup> After that, the term "global warming" more or less disappeared from US President George H.W.

6 See https://www.nasa.gov/topics/earth/features/climate\_by\_any\_other\_name.html.

<sup>2</sup> Tisher, S.S. (2021), "A climate chronology", University of Maine (https://umaine.edu/climatechronology/wp-content/uploads/ sites/575/2022/02/Climate-Chronology-January-2021-212022-1.pdf).

<sup>3</sup> Arrhenius, S. and E.S. Holden (1897), "On the influence of carbonic acid in the air upon the temperature of the earth", *Publications of the Astronomical Society of the Pacific*, 9 (54), 14-24.

<sup>4</sup> Broecker, W.S. (1975), "Climatic Change: Are We on the Brink of a Pronounced Global Warming?", *Science New Series*, 189 (4201), 460-463.

<sup>5</sup> See http://image.guardian.co.uk/sys-files/Environment/documents/2008/06/23/ClimateChangeHearing1988.pdf.

<sup>7</sup> See https://www.rte.ie/brainstorm/2021/0708/1233848-climate-change-terminology-global-warming-greenhouse-gas/.

<sup>8</sup> Samenow, J., "Debunking the claim 'they' changed 'global warming' to 'climate change' because warming stopped", *The Washington Post*, 29.1.2018 (https://www.washingtonpost.com/news/capital-weather-gang/wp/2018/01/29/debunking-the-claim-they-changed-global-warming-to-climate-change-because-its-cooling/).

<sup>9</sup> United Nations (1992), *United Nations Framework Convention on Climate Change*, Bonn, Germany.

<sup>10</sup> See http://www.exponentialimprovement.com/cms/uploads/a-cleaner-safer-healthier.pdf.

Bush's speeches on the environment, and was replaced by the term "climate change".<sup>11</sup> Furthermore, in 2005 the US National Academies published a brochure expressing the view that "climate change" was a more comprehensive scientific description of what is happening on the planet because, as opposed to "global warming", it helps convey that there are other changes in addition to rising temperatures.<sup>12</sup>

Nowadays, according to a growing number of reputable media, the phrase "climate change" does not cut it anymore, as it is too neutral, too worn-out and too nice-sounding to describe the crisis facing the planet.<sup>13</sup> According to The Guardian, the phrase "climate change" sounds rather passive and mild at a time that scientists warn about a catastrophe for humanity. In fact, it has updated its style guide to introduce new terms describing more accurately the environmental crises facing the planet, such as "climate emergency", "climate crisis" or "climate breakdown".<sup>14</sup> The Observer and other media, such as the BBC and the US Associated Press, have also amended their internal rules for climate reporting.<sup>15</sup>

#### **Climate crisis**

Nowadays, the use of the term "climate crisis" is widespread in both international and domestic media. "Climate crisis" is not a scientific term and thus does not feature in scientific dictionaries and glossaries of international environmental organisations. In prestigious English dictionaries (such as Cambridge, Collins and Oxford)<sup>16</sup> the definition of climate crisis varies, as it describes the current situation rather than a climatic term. It is therefore no coincidence that "climate crisis" tends to become the prevalent term in public discourse, since it describes more emphatically and clearly the consequences of climate change, which are the result of extreme weather events such as floods, prolonged heat waves and wildfires.

Al Gore, US Vice-President from 1993 to 2001, is credited with coining the term "climate crisis". Twenty years ago, he had stated that "climate crisis" is the most appropriate term to signal the urgency of the issue, considering that the language we use when discussing the climate crisis is of paramount importance not only to trigger an emotional response, but also to incite to action. The Nobel Peace Prize 2007 was awarded jointly to Al Gore and the Intergovernmental Panel on Climate Change (IPCC) for their global climate action. In his Nobel Lecture he stated: "We must understand the connections between the climate crisis and the afflictions of poverty, hunger, HIV-Aids and other pandemics. As these problems are linked, so too must be their solutions".<sup>17</sup> Environmental organisations and Democratic lawmakers believe it evokes emphatically the gravity of the threats facing the planet from continued greenhouse gas emissions and can help spur the political willpower that has long been missing from climate advocacy.<sup>18</sup>

<sup>11</sup> Lee, J., "A call for softer, greener language", The New York Times, 2.3.2003 (https://www.nytimes.com/2003/03/02/us/acallfor-softer-greener-language.html).

<sup>12</sup> National Academy of Sciences, National Academy of Engineering, Institute of Medicine, National Research Council (2005), Understanding and responding to climate change: highlights of National Academy Reports, Washington DC: National Academy of Sciences.

<sup>13</sup> Yoder, K., "Is it time to retire 'climate change'?", Grist Magazine, 17.6.2019 (https://grist.org/article/is-it-time-to-retire-climatechange-for-climate-crisis/).

<sup>14</sup> Carrington, D., "Why the Guardian is changing the language it uses about the environment", *The Guardian*, 17.5.2019 (https://www.theguardian.com/environment/2019/may/17/why-the-guardian-is-changing-the-language-it-uses-about-the-environment).

<sup>15</sup> See https://www.cleanenergywire.org/blog/climate-change-or-climate-crisis-whats-right-lingo.

<sup>16</sup> The definition of climate crisis is as follows: (a) In the Cambridge dictionary: serious problems that are being caused or likely to be caused by changes in the world's weather, in particular the world getting warmer as a result of human activity increasing the level of carbon dioxide in the atmosphere (see https://dictionary.cambridge.org/dictionary/english/climate-crisis). (b) In the Collins dictionary, as a situation of imminent environmental catastrophe brought about by climate change (see https://www.collinsdictionary.com/dictionary/english/climate-crisis). (c) In the Oxford dictionary, as a situation in which immediate action is needed to reduce or stop climate change and prevent serious and permanent damage to the environment (see https://www.oxfordlearnersdictionaries.com/definition/english/climate-crisis?q=climate+crisis).

<sup>17</sup> See https://www.nobelprize.org/prizes/peace/2007/gore/26118-al-gore-nobel-lecture-2007/.

<sup>18</sup> Sobczyk, N., "How climate change got labeled a 'crisis'", Energy & Environmental News, 10.7.2019.

In November 2019, eleven thousand scientists from all over the world signed a declaration on the climate entitled "Warning of a Climate Emergency", stating that the Earth is facing a climate emergency due to insufficient efforts to tackle the climate crisis on an international scale.<sup>19</sup>

#### Conclusions

The climate is changing and so is the name describing this change. The terminology used is evolving in line with developments, highlighting the fact that climate change has hardened into a climate crisis and emphasising the huge impact that climate change already has on human life, ecosystems and biodiversity. Mustering the communicative power of words in the fight against climate change indicates the seriousness of the issue. The European Commission's European Green Deal provides recommendations on education and training as part of the solution for the changes required for a successful transition to a greener life.<sup>20</sup> The issue is not only how climate change is put in words, but also to whom it is addressed and how it is conveyed. Climate change coverage in news footage, newspapers and their websites could target more the youth. Education and environmental literacy can communicate climate change; the origin of greenhouse gas emissions; the benefits of circular economy, reusing and recycling; existing and future solutions; and, above all, what small things can be done by groups and individuals alongside action at global, national and local level.

19 The declaration was published in January 2020. See Ripple, W.J., C. Wolf, T.M. Newsome, P. Barnard, W.R. Moomaw (2020), "Warning of a climate emergency", *BioScience*, 70 (1), 8-12.

20 European Commission (2019), The European Green Deal, Brussels.

#### Box X.2

# THE CONTRIBUTION OF THE GREEN CAPITAL MARKETS UNION TO THE EUROPEAN ECONOMY

Achieving the goals of the European Green Deal<sup>1</sup> on sustainable development and net-zero greenhouse gas emissions by 2050, as well as the intermediate goals for 2030 ("Fit for 55"),<sup>2</sup> creates new challenges, but also opportunities, as it is linked to a need for additional investment. In particular, Europe will need an estimated €350 billion in additional investment per year over this decade to meet its 2030 emissions-reduction target in energy systems alone, alongside the €130 billion it will need for other environmental goals.<sup>3</sup> Meanwhile, a faster shift to clean energy has become more urgently necessary in the new geopolitical context following Russia's invasion of Ukraine.<sup>4</sup> The size of the investment needed implies that a combination of funds from the EU budget and public and private investments will be required. The European Commission has stated that it will continue to work on how to further mobilise resources to achieve the objectives of the Green Deal. The Sustainable Europe Investment Plan will mobilise sustainable investment of at least €1 trillion over the next decade, through the EU budget, while it will also crowd in private funding through guarantees under the InvestEU Programme.<sup>5</sup> In this direction, under the 2021-2027 Multiannual Financial Framework and NextGenerationEU (NGEU), the EU aims to spend up to EUR 605 billion on projects addressing the climate crisis and €100 billion on projects supporting biodiversity. Of the €750 billion allocated for NGEU, 30% will be raised through issuance of green bonds.

<sup>1</sup> https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019DC0640.

<sup>2</sup> https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0550&from=EN.

<sup>3</sup> https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021DC0390&from=EN.

<sup>4</sup> In their recent Versailles Declaration (11 March 2022), EU leaders recognised that the current situation calls for a thorough reassessment of how the EU ensures the security of its energy supplies and highlighted the need to reduce energy dependencies.

<sup>5</sup> See https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0021. The plan is accompanied by a Just Transition Mechanism, which will mobilise investments of at least €143 billion and help the shift of highly carbon-dependent regions to new types of economic activity, as it is important to make sure that no one is left behind in the transition towards a climate-neutral economy by 2050.

Financing in the EU is characterised by greater reliance on bank lending, among other things due to the more favourable tax treatment of debt compared to equity investment, as well as a preference for shorter-term assets rather than the placements. Moreover, investments in the EU are usually within the borders of Member States (home bias), mainly due to differences in the legal framework of national markets, e.g. in corporate insolvency rules. The expansion of green finance can be a driving force towards a carbon-neutral economy, financial integration and stability in the euro area.

Markets are an important source of funding for the economy and can play a crucial role in economic growth in the post-pandemic period, reducing the risk of uneven recovery across Member States. A healthy and dynamic capital market, which provides an alternative for raising funds to promote green innovation and finance long-term projects, is expected to support the transition to a low-carbon economy and, at the same time, the digital transition. The green transition offers the opportunity to build a truly pan-European capital market – in other words, a green capital markets union.<sup>6</sup> The development of a green capital markets union can support the completion of the Capital Markets Union by adding depth and diversification to the financial instruments available, while also enhancing the risk sharing capacity of the EU financial system.<sup>7</sup>

#### The green bond market in the EU

Achieving EU policy goals focusing on the green and digital transition requires the mobilisation of investment resources and the development of appropriate finance instruments. The EU is a global leader in the development of green capital markets. At present, the green bond market displays a higher degree of integration across the euro area than the aggregate bond market, with green bonds being roughly twice as likely as other types of bonds to be held cross-border within the euro area.<sup>8</sup>

Green capital markets are dynamic and rapidly growing, which bodes well for more sustainable investment and green bond financing. From 2007 to the end of 2021, green bonds<sup>9</sup> worth  $\in$ 1.43 trillion were issued at a global level, of which  $\in$ 429 billion in 2007-2018 and the remaining  $\in$ 997 billion in the period from 2019 onwards (see Chart A). It is worth noting that, in 2021 alone, green bond issuance came to  $\in$ 496 billion. The strong growth of the green bond market and the acceleration of green bond issuance activity are developments that are particularly relevant for the European capital markets. Green bonds totalling  $\in$ 804 billion have been issued on euro area capital markets, of which  $\notin$ 645 billion by entities established in a euro area Member State.

Green bond issues are increasingly launched by the private sector, while issues by the public sector (sovereigns, local and regional authorities and related entities) continue to raise funding for projects and investment programmes linked to sustainability goals (see Chart B). It is encouraging that European companies so far seem to lead the way in the issuance of instruments that finance sustainable activities. Should this trend continue, it could point to a stepping-up of private sector engagement in the sustainability agenda going forward. Consequently, the deepening and further integration of euro area capital markets, with a focus on financing sustainable investments, will contribute to the creation of a single European capital market for green financial instruments.

**Strengthening of the EU institutional framework for sustainable finance and the Capital Markets Union** The renewed EU strategy on sustainable finance identifies four main areas where additional action is needed

<sup>6</sup> https://www.ecb.europa.eu/press/key/date/2021/html/ecb.sp210506~4ec98730ee.en.html.

<sup>7</sup> Green bond markets are characterised by a higher degree of integration and relatively low home bias. Therefore, encouraging green finance is a very effective way to strengthen financial integration. Also, investment funds that meet environmental, social and governance (ESG) criteria appear to be more stable, as their investors are less likely to withdraw following negative performance than non-ESG investors – see Capota, L., M. Giuzio, S. Kapadia and D. Salakhova (2021), "Are ethical and green investment funds more resilient?", mimeo; and Alogoskoufis et al. (2021), "Climate-related risks to financial stability", Special Feature, ECB, *Financial Stability Review*, May 2021.

<sup>8</sup> https://www.ecb.europa.eu/pub/financial-stability/macroprudential-bulletin/focus/2021/html/ecb.mpbu\_focus202110\_ 3.en.html. See also Box II.2 in this Report.

<sup>9</sup> The analysis covered about 5,500 issues of securities identified as "green bonds" on the Refinitiv platform, based on the use of proceeds in sustainable projects according to the prospectus of the issue.



Source: Refinitiv and Bank of Greece calculations.

Note: The chart shows green bond issuance per year for the period 2013-2021. These bonds were selected on the basis of Refinitiv financial market data. Bonds characterised as green were selected and classified by issuing country and year. The countries were then aggregated to sum up the issuing activity of euro area countries.

for the financial system to fully support the transition of the economy towards sustainability: (a) financing the path of the real economy towards sustainability; (b) more inclusive sustainable finance; (c) improving the financial sector's resilience and contribution to sustainability; and (d) fostering global ambition.<sup>10</sup> At the same time, recognising that a well-functioning Capital Markets Union can have a significant stabilising effect and help the EU recover from the COVID-19 pandemic, the European Commission presented a plan in 2020, comprising 16 actions aimed to address key remaining challenges on the path towards the Capital Markets Union.<sup>11</sup> The plan identifies a need for deep and liquid capital markets, as well as the opportunity for the EU financial system to attract more investors and issuers globally to euro-denominated financial instruments, thereby strengthening the international role of the euro. One of the three key objectives of the new plan is to support a green and digital economic recovery by making financing more accessible to European businesses, through improved availability and accessibility to sustainability-related data.

<sup>10</sup> Actions that are identified as important for financing the transition and are relevant to capital markets include: adoption of legislation to support the financing of certain economic activities that help to reduce greenhouse gas emissions; extending the EU Taxonomy framework and developing a general framework of standards and labels for sustainable financial instruments; leveraging the opportunities offered by digital technologies; reflecting sustainability risks in financial reporting standards and accounting; improving transparency of credit ratings; developing appropriate micro- and macro-prudential tools for sustainability risks, etc. See Communication from the Commission "Strategy for Financing the Transition to a Sustainable Economy", 6.7.2021, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0390.

<sup>11</sup> Communication from the Commission "A Capital Markets Union for people and businesses", 24.9.2020, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2020%3A590%3AFIN.

Meanwhile, the EU has taken legislative initiatives for the financial system that support the financing of sustainable development through capital markets.<sup>12</sup> The introduction of common standards, labels and credit rating criteria will contribute to adequate and targeted financing and enhance the credibility of markets. Furthermore, the improvement of corporate sustainability practices for and relevant disclosures, e.g. the obligation of companies to publicly disclose their greenhouse gas emissions reduction targets and performance against the targets, will help to channel investments into financing the transition to a low-emission economy. These actions could also strengthen the integrity of the EU financial system and markets and reduce the risk of greenwashing.

The development of a green capital markets union is linked to further progress in addressing the shortcomings of the EU Capital Markets Union, to the harmonisation of corporate insolvency legislation and investor protection rules, as well as to the strengthening of integrated cross-border market supervision. Important elements of a green capital markets union include transparency standards (according to which companies are required to disclose sustainability data), EU-certified green financial products such as the proposed Green Bond EU Standard, and a harmonised regulatory and supervisory framework for sustainable finance. The completion of the EU's strategic actions and the creation of the necessary legal framework for the financial sector will put in place the enabling conditions for financing the transition to a sustainable European economy and for increasing the participation of capital markets in financing. The European Commission's proposal for a voluntary Green Bond Standard based on the EU Taxonomy is a positive step in this direction. However, making this standard mandatory within a reasonable period of time would enhance the credibility of green investments. Similar initiatives are also necessary for instruments that finance other aspects of sustainable development (e.g. sustainable bonds or social bonds). Finally, the legislative framework will need to be sufficiently flexible to accommodate financial innovation, helping to meet funding needs.

#### The role of central banks

Physical risks, such as the higher frequency and severity of extreme weather events, as well as transition risks, e.g. from a late and abrupt transition to a low-carbon economy, could affect the transmission of monetary pol-





Source: Refinitiv and Bank of Greece calculations.

Note: The charts show the value of Greek green bond issues in the period 2013-2021 in capital markets of the euro area, the United States and other economies, by issuers of the private sector (financial institutions and non-financial corporations) and the public sector (supranational organisations, federal states and public sector corporations).

<sup>12</sup> Such as the Sustainable Finance Disclosure Regulation, the (amended) Regulation on EU Climate Transition and Parisaligned Benchmarks, the proposal for a Regulation on European Green Bonds, and the proposal for a Directive on sustainability reporting by companies.

icy and jeopardize price, financial and economic stability. Central banks around the world are already considering how the physical and transition impact of climate change can be included in macroeconomic forecasting and financial stability monitoring. Also, they have been undertaking work to integrate climate-related risks into prudential regulation and supervision, engaging with rating agencies and financial firms s to ensure that climate-related risks are understood, disclosed and incorporated in risk assessment and in credit provision decisions.

In the summer of 2021, the Governing Council of the ECB approved a comprehensive action plan, with an ambitious roadmap to further incorporate climate change considerations into the ECB's policy framework to more systematically reflect environmental sustainability criteria in monetary policy. The ECB supports ongoing EU initiatives to improve the disclosure of climate data, in order to enhance transparency and promote a market for green financial instruments.<sup>13</sup>

13 See the article by the Governor of the Bank of Greece entitled "Central banks and climate change", Handelsblatt, 29.9.2021.

# 2 GREENHOUSE GAS EMISSIONS IN THE EU AND GREECE

In 2019, greenhouse gas (GHG) emissions in the EU28 plus Iceland amounted to 4,067.1 million tonnes of  $CO_2$  equivalents, their lowest level since 1990. This represents a drop of 28.3% relative to 1990, which occurred despite GDP growth by more than 64% over the same period (see Table X.1) and was supported by a variety of factors, including a rebalancing of the energy mix towards more renewables, the use of less carbon intensive fossil fuels and improvements in energy efficiency, structural changes in the economy, and lower energy demand by house-holds for heating, as winters in Europe have, on average, been milder since 1990. Moreover, the overall reduction in GHG emissions has been supported, at the EU and national level, by key agricultural and environmental policies in the 1990s and climate and energy policies in the 2000s.<sup>30</sup>

In 2020, aggregate GHG emissions in the EU27 (excluding the United Kingdom) fell by about 8% relative to 2019 and stood 34% below 1990 levels. Compared with 1990, emissions were down in most EU Member States, while they rose in Cyprus and Ireland. The reduction in emissions in 2020 was due to several factors, including the growing use of renewables for electricity generation and the substitution of fossil natural gas for conventional fossil fuels that have become costlier. The recessionary impact of the COVID-19 pandemic on the economies of individual Member States (all but Ireland experienced a GDP contraction) also played a role in GHG emission reductions across the EU.<sup>31</sup>

Looking at a sectoral breakdown, the majority of sectors reduced their emissions between 1990 and 2019. The largest declines occurred in public electricity and heat production, manufacturing industries excluding iron and steel, the residential sector, and in the iron and steel production sector (-620, -267, -136 and -126 million tonnes of  $CO_2$  equivalents, respectively). The factors behind this include energy efficiency improvements in industrial plants and greater energy savings by household and business users thanks to better building insulation and the growing use of more energy efficient appliances. By contrast, road transportation and refrigeration-air conditioning saw their emission levels increase by 176 and 83 million tonnes of  $CO_2$  equivalents, respectively.<sup>32</sup>

<sup>30</sup> European Environment Agency, Annual European Union greenhouse gas inventory 1990-2019 and inventory report 2021, 27 May 2021.

<sup>31</sup> European Environment Agency, Trends and projections in Europe 2021, EEA Report No. 13/2021.

<sup>32</sup> European Environment Agency, Annual European Union greenhouse gas inventory 1990-2019 and inventory report 2021, 27 May 2021.

Table X.1	Greenhouse o	as emissions <sup>1</sup>
Table A.T	Greenhouse g	as emissions

(in million tonnes of CO<sub>2</sub> equivalents)

	1990	2019	Change 2018-2019	Change 1990-2018	Change 1990-2019	Change 1990-2000*
Country	(million to	onnes)				
Austria	78.4	79.8	1.5	-7.7	1.8	-6.1
Belgium	145.7	116.7	-1.1	-7.4	-19.9	-25.8
Bulgaria	100.0	56.0	-2.3	-7.5	-44.0	-48.2
Croatia	31.4	23.6	0.3	-1.7	-24.8	-26.1
Cyprus	5,6	8.8	0.3	-5.6	58.7	49.8
Czech Republic	198.9	123.3	-4.6	-3.5	-38.0	-40.2
Denmark	70.9	44.2	-8.1	-7.7	-37.6	-42.4
Estonia	41.0	14.7	-27.3	-21.2	-64.2	-71.8
Finland	71.2	53.1	-5.8	-9.0	-25.5	-32.2
France	544.0	436.0	-1.9	-9.2	-19.9	-27.3
Germany	1,248.6	809.8	-5.4	-8.7	-35.1	-40.8
Greece	103.3	85.6	-7.2	-13.7	-17.1	-28.4
Hungary	94.8	64.4	-0.5	-1.4	-32.0	-32.9
Iceland	3.7	4.7	-2.1	-5.0	-28.2	21.8
Ireland	54.4	59.8	-4.4	-3.7	9.9	5.8
Italy	518.7	418.3	-2.4	-8.6	-19.4	-26.3
Latvia	25.9	11.1	-1.1	-6.1	-57.0	-59.6
Lithuania	47.8	20.4	1.1	-1.6	-57.4	-27.4
Luxembourg	12.7	10.7	1.7	-14.0	-15.6	-18.4
Malta	2.6	2.2	6.5	-2.6	-16.2	-18.4
Netherlands	220.5	180.7	-3.2	-9.0	-18.0	-25.4
Poland	475.9	390.7	-5.1	-4.4	-17.9	-21.5
Portugal	58.9	63.6	-5.4	-8.5	8.1	-1.1
Romania	266.4	113.9	-3.6	-4.7	-57.3	-59.3
Slovakia	73.5	40.0	-5.3	-5.8	-45.6	-48.7
Slovenia	18.6	17.1	-2.6	-6.2	-8.2	-13.9
Spain	290.0	314.5	-5.6	-13.7	8.5	-6.4
Sweden	71.2	50.9	-2.4	-6.8	-28.5	-33.4
United Kingdom	794.1	452.3	-2.9	-	-43.0	-
EU plus Iceland <sup>2</sup>	5,668.7	4,067.1	-3.9	-8.1	-28.3	-31.9

Sources: European Environment Agency, Annual European Union greenhouse gas inventory 1990-2019 and inventory report 2021, May 2021. For 2020: European Environment Agency, Approximated EU greenhouse gas inventory – Proxy GHG emission estimates for 2020, November 2021.

\* Figures in these columns refer to the EU without the UK (EU27).

1 Total GHG emissions, excluding land use, land-use changes and forestry.

2 The EU, Iceland and the UK jointly report their national GHG emissions during the second commitment period of the Kyoto Protocol, reflected in the Doha Amendment.

# In 2019, the bulk of GHG emissions in the EU28 was accounted for by Germany, the United Kingdom, France and Italy,<sup>33</sup> which reduced their combined share in total EU GHG emissions (to 52.0% from 54.8% in 1990), while the majority of EU countries had shares of less than

<sup>33</sup> The shares of the four largest emitters in 2019 were as follows: Germany: 19.9%; United Kingdom: 11.1%; France: 10.7%; and Italy: 10.3%, compared with 22.0%, 14.0%, 9.6% and 9.2%, respectively, in 1990. The smallest emitters were Malta, Cyprus, Luxembourg, Latvia, Slovenia, Estonia and Lithuania, with shares ranging between 0.1% and 0.5%.

(in million tonnes of CO<sub>2</sub> equivalents)

2%. On the other hand, Germany and the United Kingdom were also the countries with the largest emission reductions between 1990 and 2019 (-438.8 and -341.8 million tonnes of  $CO_2$  equivalents, respectively). In Germany, this was mainly due to increased efficiency of heating facilities and economic restructuring, particularly in the iron and steel sector. Other important factors include a switch from coal to natural gas, a strong increase in renewable energy use, and waste management measures. Lower emissions in the United Kingdom were primarily the result of liberalising energy markets and the fuel switch from oil and coal to gas in electricity production. Decreasing iron and steel production and the implementation of methane recovery systems at landfill sites contributed to a lesser extent. However, significant reductions were also achieved by small emitters, such as Romania, Slovakia and Hungary (-152.5, -33.5 and -30.4 million tonnes of  $CO_2$  equivalents, with shares of 2.8%, 1.0% and 1.6%, respectively.

Looking at the percentage breakdown between the six main GHGs, carbon dioxide (CO<sub>2</sub>) has the largest share, at 81.0% of total EU GHG emissions in 2019 (1990: 79.3%), followed by methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) with 10.9% and 6.3%, respectively, down from 12.9% and 7.2% in 1990. CO<sub>2</sub> emissions showed the largest decline, while CH<sub>4</sub> and N<sub>2</sub>O emissions also fell substantially as a result of reduced mining activity and improved waste management.<sup>34</sup>

A breakdown by source category (see Table X.2) shows that the far largest share, 70% of total EU GHG emissions in 2019, came from the energy sector (3,132 Mt  $CO_2e$ ), followed by agriculture with a share of 10.5% (429 Mt  $CO_2e$ ), industrial processes with 9.1% (370 Mt  $CO_2e$ ) and the waste sector with 3.3% (135 Mt  $CO_2e$ ).<sup>35</sup>

	1990	1995	2000	2005	2010	2014	2015	2016	2017	2018	2019
EU28											
Energy	4,358	4,081	4,012	4,123	3,801	3,336	3,376	3,357	3,361	3,282	3,132
Industrial processes	530	506	463	473	397	369	381	381	390	380	370
Agriculture	537	469	459	437	423	432	433	434	437	432	429
Waste	240	246	228	200	167	145	142	139	138	136	135
Other	0	0	0	0	0	0	0	0	0	0	0
Indirect CO <sub>2</sub> emissions	4.00	4.00	3.00	3.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Total*	5,669	5,305	5,166	5,236	4,790	4,303	4,335	4,312	4,327	4,233	4,067
				Greece							
Energy	77	81	97	107	93	74	71	67	70	67	61
Industrial processes	11	14	15	15	12	12	12	13	13	12	12
Agriculture	10	9	9	9	9	8	8	8	8	8	8
Waste	5	5	5	5	5	4	4	5	5	5	5
Total*	103.3	109.3	126.5	136.4	118.5	99.3	95.5	91.8	95.6	92.3	85.6

Table X.2 Greenhouse gas emissions by source category in the EU<sup>1</sup> and Greece

Sources: European Environment Agency, Annual European Union greenhouse gas inventory 1990-2019 and inventory report 2021, May 2021. For Greece: Ministry of Environment and Energy, Climate Change Emissions Inventory, March 2021.

Total GHG emissions, excluding land use, land-use changes and forestry.

1 The EU, Iceland and the UK jointly report their national GHG emissions during the second commitment period of the Kyoto Protocol, reflected in the Doha Amendment. The EU28 aggregate therefore includes Iceland.

<sup>34</sup> More specifically,  $CO_2$  emissions came to 3,296 million tonnes in 2019, 26.7% lower than in 1990.  $CH_4$  and  $N_2O$  emissions, at 443 and 255 million tonnes of  $CO_2$  equivalents, respectively, were also lower than 1990 levels (by 39.2% and 37.3%).

<sup>35</sup> Average annual changes relative to 1990 were: energy-related activities: -28.1%, agriculture: -20.1%, industrial processes: -30.2% and waste: -43.8%.

In Greece, after an upward trend in 1990-2007 (in the context of rising living standards and a growing services sector), emissions followed a declining path in 2008-2019.<sup>36</sup> This development was mainly due to economic recession, but also to mitigation actions (a shift to more renewables and improved energy efficiency). Between 2018 and 2019, Greece reduced its GHG emissions by 7.2%, mainly driven by the energy sector. This sector has a huge weight in GHG emissions, 71.5% of the national total in 2019 (1990: 74.6%), and reduced its emissions by 20.5% relative to 1990.<sup>37</sup> The second most important source category was industrial processes with a share of 13.6%. Agriculture (including livestock farming) comes third with a share of 9.2%. This sector saw its emissions decrease significantly (-22.2%) between 1990 and 2019, mainly due to lower N<sub>2</sub>O emissions from agricultural soils, less use of synthetic nitrogen fertilisers and falling livestock numbers. Reduced use of synthetic nitrogen fertilisers and falling livestock numbers. Reduced use of synthetic nitrogen fertilisers is attributable to a rise in organic farming, the high cost of fertilisers and the adoption of sound fertilisation practices. Waste had a share of 5.7% in total GHG emissions in 2019 and its emissions were marginally (0.5%) lower than in 1990, largely thanks to increased recycling.

Turning to a breakdown by greenhouse gas,  $CO_2$  emissions accounted for 76.8% of the national total in 2019 and were 21.2% lower than in 1990, mainly as a result of the introduction of natural gas and renewable energy in power generation. It is worth noting that Greece's high available hydroelectric potential also played a significant part in emission reduction. The second most important greenhouse gas was methane (CH<sub>4</sub>), with a share of 11.7%; its emissions declined by 9.3% compared with 1990 levels.<sup>38</sup>

### 3 DOMESTIC POLICY MEASURES IN THE AREAS OF ENERGY, ENVIRONMENT AND CLIMATE IN 2021

On 16 March 2021, Law 4784/2021 on sustainable urban mobility was published.

On 28 April 2021, the Greek government submitted to the European Commission a National Recovery and Resilience Plan, "Greece 2.0", identifying green transition as its no. 1 objective.

On 23 July 2021, Law 4819/2021 was published, establishing a comprehensive framework for waste management.

On 6 September 2021, the establishment of a new Ministry of Climate Crisis and Civil Protection was officially announced.

On 20 September 2021, Greece hosted the EUMED9 summit and, along with eight other Mediterranean countries of the EU, co-signed the "Athens Declaration", whereby the parties reiterated their commitment to implement the Paris Agreement.

On 20 October 2021, Law 4843/2021 was published, transposing the EU Energy Efficiency Directive into Greek law and introducing other provisions on promoting renewable energy and competition in the electricity market.

On 18 November 2021, the Ministry of Environment and Energy published a draft National Climate Law – Transition to climate neutrality and adaptation to climate change, put up for public consultation between 24 November 2021 and 28 January 2022. The draft law Greece's national

<sup>36</sup> However, GHG emissions rose in 2017 year-on-year, mainly due to increased use of solid fuels.

<sup>37</sup> Within this source category, power generation is responsible for the majority of emissions (52.2%), followed by transport and manufacturing-construction with smaller shares of 29.1% and 7.5%, respectively.

<sup>38</sup> Ministry of Environment and Energy, Greece – National Inventory Report 2021, March 2021.

targets for reducing GHG emissions by 2030 and 2050, respectively, and the actions required in each of the country's seven top emitting sectors.

On 10 December 2021, Law 4872/2021 was published, on just and growth-friendly transition and specific issues of de-lignitisation.

On 13 and 30 December 2021, the Public Gas Distribution Networks S.A. (DEDA) announced that it expected to launch three pilot projects in 2022 (two for the distribution of biomethane in the prefectures of Serres and Imathia<sup>39</sup> and one for the production, distribution and use of natural gas-based hydrogen to fully meet the energy needs of one settlement in the prefecture of Florina).<sup>40</sup> They would be the first such projects in Greece.

On 28 February 2022, the Greek Minister of Environment and Energy provided the EU Council of Ministers with a Greek government proposal to create an EU Energy Crisis Solidarity Facility to cushion households and businesses from the impact of the global energy crisis.<sup>41</sup>

On 9 March 2022, the Prime Minister, in a letter to the President of the European Commission, proposed a Six-Point Plan for protecting and restoring the smooth functioning of the gas and electricity wholesale markets and for ensuring that EU Member States' citizens and economies do not "unduly suffer in an already challenging period".

On 16 and 17 March 2022, the Prime Minister and the Minister of Environment and Energy, respectively, stated that Greece pursues its energy self-sufficiency, among other things by utilising its renewable energy sources and economically viable natural gas reserves, while also seeking to become a green energy hub for entire Europe.

#### Box X.3

### CLIMATE CHANGE AND THE BANKING ENVIRONMENT<sup>1</sup>

Climate change, i.e. the change in the global climate as a result of human activity (anthropogenic climate change), caused mainly by an increase in the concentration of greenhouse gases (GHG) in the atmosphere, affects the natural environment, and thereby the economy and the financial system. The impact of climate change on financial stability is associated with the distribution and types of financial assets exposed to climate-related and environmental risks. These risks relate to the physical impacts of climate change (physical risks) and to the process of transition to a low emissions economy (transition risks), while the cost is significantly reduced by implementing the necessary measures in a timely and orderly manner. Therefore, climate change falls directly within the mandate of central banks –including the Bank of Greece– to, *inter alia*, ensure financial stability.

#### Climate change and the banking system: risks and interconnection

The main cause of climate change is the increase in global average temperature, which can lead to, among other things, sea level rise, floods, droughts, extreme weather events and extinction of species and ecosystems.<sup>2</sup> Dam-

<sup>39</sup> See Public Gas Distribution Networks S.A. (DEDA) press release, 6.12.2021 (in Greek).

<sup>40</sup> See Public Gas Distribution Networks S.A. (DEDA) press release, 30.12.2021 (in Greek).

<sup>41</sup> See Ministry of Environment and Energy press releases of 27 and 28.2.2022 (in Greek): https://ypen.gov.gr/kostas-skrekasoi-ellinikes-protaseis-sto-avriano-symvoulio-ypourgon-energeias/ and https://ypen.gov.gr/kostas-skrekas-apofasistiki-kai-syntonismeni-evropaiki-drasi-gia-tin-antimetopisi-tis-energeiakis-krisis/.

<sup>1</sup> Summary of Special Feature I: "Climate change and the banking environment", *Financial Stability Review*, December 2021 (in Greek).

<sup>2</sup> Bank of Greece, The environmental, economic and social impacts of climate change in Greece, June 2011.

age from extreme weather events and the disruption of production processes is one example of the direct consequences of changes in weather patterns, along with the effects of long-term climate changes. These effects will in turn lead to a slowdown in productivity (e.g. declining crop yields, damages to businesses and infrastructure, loss of working hours and health problems due to extreme weather events), capital losses and additional expenditure for damage repair. As regards transition risks, businesses are faced with rising gas emission costs and compliance costs. The development of new green technologies, the improvement of energy efficiency and a potential decrease in the demand for environmentally harmful products may further weigh on the financial situation of some businesses and on households' disposable income. These impacts on the real economy are expected to affect the banking system; however, identifying and measuring the related risks in banks' risk assessment models is a challenge. The connection between climate-related risks and traditional banking risks mainly refers to:<sup>3</sup>

a) credit risk, since borrowers' debt-servicing capacity and/or banks' ability to fully recover the value of a loan in the event of a borrower's default are impaired (e.g. potential impact on the borrower's income and capital and/or the value of collateral due to extreme weather events and disruption of production processes);

b) market risk, in terms of adjustments in the value of financial assets when climate risk has not yet been fully reflected into the pricing of exposures (e.g. losses from declining prices of corporate bonds after a natural disaster);

c) liquidity risk, as banks' access to stable sources of funding is affected, given that climate change may impact on deposit/credit flows (e.g. when credit lines and deposits are used and withdrawn, respectively, to address damages from natural disasters) and securities holdings (fire sales); and

d) operational risk, as natural disasters (e.g. floods, wildfires) may cause damages that directly affect the operation of banks' facilities (e.g. branches, central units) and also companies with which a bank cooperates in providing services to its customers and which may be exposed to natural hazards.

Moreover, a bank's legal and reputational risk may increase where it finances activities with a high level of GHG emissions or promotes products as sustainable while in reality they are not environmentally friendly ("green-washing", see also Box II.3).

The complexity of the climate change challenge and our still incomplete understanding of its impacts on macroeconomic indicators such as inflation and interest rates make further research necessary, and to this end, central banks are already developing particular actions.<sup>4</sup> On the other hand, climate change could create new opportunities to develop a bank business model that is geared towards financing of sustainable activities, innovative products and projects for climate change adaptation, in order to promote transition towards a low-emissions economy. It should be noted, however, that the growth of the necessary financing is hampered by the lack of definitions and criteria commonly accepted and widely used by stakeholders and markets, which would enable a reliable identification and assessment of those investments that are aligned with greenhouse gas emission reduction targets.

### Climate change and global initiatives

The Paris Agreement (2015) set out goals and a framework to strengthen countries' ability to deal with the impacts of climate change. Similarly, as most central banks acknowledged in time climate change as a challenge for the financial system, they have undertaken and continue to undertake important actions to address it within their competences and in line with their mandate. Furthermore, the Basel Committee on Banking Supervision (BCBS), in the context of its relevant actions on climate change,<sup>5</sup> has been assessing the extent to which climate-related

<sup>3</sup> ECB (2021), "Climate-related risk and financial stability", July 2021, and "Climate change and monetary policy in the euro area" September 2021, and Papandreou, A.A. (2019), "Stranded assets and the financial system", Bank of Greece, Working Paper No. 272.

<sup>4</sup> ECB press release, "ECB's Governing Council approves its new monetary policy strategy", 8.7.2021.

<sup>5</sup> BIS, "Basel Committee advances work on addressing climate-related financial risks", November 2021.

financial risks can be addressed within the framework of existing rules. Furthermore, the Network of Central Banks and Supervisors for Greening the Financial System (NGFS), of which the Bank of Greece is a member, in order to contribute towards achieving the objectives of the Paris Agreement, among other things published in May 2020 a Guide with recommendations and best practices for the integration of climate-related and environmental risks into supervisory activities.<sup>6</sup> One of these recommendations is to develop a clear strategy and establish internal arrangements to address climate-related issues.

At the 26th United Nations Climate Change Conference of the Parties (COP26) in Glasgow (October-November 2021), countries further committed to reducing greenhouse gas emissions (mainly carbon dioxide and methane) and to addressing deforestation by financing actions.<sup>7</sup> In the context of this conference, the NGFS, the ECB and 68 central banks that are members of the NGFS –including the Bank of Greece<sup>8</sup>– committed to take further actions to facilitate the transition to a carbon-neutral economy and achieve the objectives of the Paris Agreement. In addition, major banking groups that control around 40% of the world's financial assets reiterated in a joint statement their readiness to substantially support green growth through targeted lending.

#### EU initiatives on tackling climate change and protecting the financial system

The European Union, under the European Green Deal and the plan to achieve interim emissions' reduction targets by 2030,<sup>9</sup> aims at a growth model that is based on sustainable economic activities, as these will be defined in the relevant classification system currently under development (EU Taxonomy Regulation<sup>10</sup>). In addition, the proposal for an EU Regulation<sup>11</sup> on European green bonds could support the financing of sustainable growth and further deepen the green bonds markets, also by enhancing the credibility of these bonds while reducing the risk of greenwashing. The recent proposal of the "Banking Package 2021"<sup>12</sup> includes sustainability issues in banks' regulatory and supervisory framework, by integrating climate-related and environmental risks into banks' risk management framework and supervisory process. Furthermore, in November 2021, the ECB's Single Supervisory Mechanism (SSM) published a report<sup>13</sup> on banks' approaches and progress on integrating climate-related risks into their practices and meeting the relevant supervisory expectations published one year ago.<sup>14</sup> The report recognises that efforts to meet the supervisory expectations are under way and most banks have prepared plans to meet them in the near future.

In terms of climate risk analysis, in September 2021,<sup>15</sup> the ECB published the results of its first economy-wide climate stress test, an exercise that assessed the impact of climate change under three different climate policy scenarios. In Greece, while the share of firms subject to transition risk is close to the EU average, the share of firms exposed to physical risks is much higher compared with other countries. This is due to many reasons and, according to the methodology followed, it may be attributed *inter alia* to Greece's geographical location (and its vulnerability to climate change), the exposure of Greek banks to domestic firms (mainly based in Greece) and adaptation measures that have or have not been implemented. In addition, the ongoing European stress test on climate-related risks, a learning exercise to assess banks' climate-risk preparedness conducted in the first half of 2022,<sup>16</sup> aims to contribute to better understanding of the challenges that banks face in managing climate-related risks. The benchmark analysis to assess the sustainability of banks' business models and their exposure

- 12 European Commission, "Banking Package 2021: new EU rules to strengthen banks' resilience and better prepare for the future", October 2021.
- 13 ECB, "The state of climate and environmental risk management in the banking sector", November 2021.

<sup>6</sup> NGFS, "Guide for Supervisors: Integrating climate-related and environmental risks into prudential supervision", May 2020, and "Progress report on the Guide for Supervisors", October 2021.

<sup>7</sup> Glasgow Climate Change Conference, October-November 2021.

<sup>8</sup> Bank of Greece COP26 pledge, 3.11.2021.

<sup>9</sup> European Commission, European Green Deal.

<sup>10</sup> EU Taxonomy for sustainable activities.

<sup>11</sup> Regulation of the European Parliament and of the Council on European green bonds, July 2021.

<sup>14</sup> ECB, "Guide on climate-related and environmental risks", November 2020.

<sup>15</sup> ECB press release, "Firms and banks to benefit from early adoption of green policies, ECB's economy-wide climate stress test shows", September 2021.

<sup>16</sup> ECB Press Release, "ECB Banking Supervision launches 2022 climate risk stress test", 27.1.2022.

to emission-intensive companies by comparing them through a common set of climate risk metrics could also help identify vulnerabilities faced by banks and appropriately integrate the insights into the Supervisory Review and Evaluation Process (SREP).

#### The Bank of Greece's initiatives to tackle climate change and safeguard financial stability

The Bank of Greece was among the first central banks to systematically engage with the analysis of the economic, social and environmental impacts of climate change, undertaking initiatives such as the establishment of the Climate Change Impacts Study Committee (CCISC) in 2009 and contributing to the design of policy measures to limit the adverse impacts of climate change and to facilitate adaptation. The Bank of Greece was the first central bank to endorse the Principles for Responsible Banking of the United Nations Environment Programme Finance Initiative (2019) and is also a member of the NGFS and other international working groups (e.g. ECB or European Banking Authority groups). In addition, in 2021, the Bank of Greece set up the Climate Change and Sustainability Centre, whose main task is to coordinate the Bank's actions on climate and sustainability issues.

#### **Conclusions – recommendations and prospects**

Climate change requires multi-level cooperation in order to be addressed and to achieve the goals for green growth, as it is expected to have significant environmental, social and economic impacts. Central banks, within their remit, play an important role in facilitating the transition to a sustainable low-emissions economy, while at the same time safeguarding financial stability. With the development of methodologies, data availability, research and analysis and policymaking, central banks can contribute to address the impacts of climate change and financing sustainable growth. At the same time, commercial banks need to develop a modern business model, which is capable of managing the risks of climate change in their financial exposures as well as financing green growth. The benefits are expected to be significant in terms of improving their assets through new exposures to sustainable projects and activities, but also in terms of reducing non-performing loan ratios. The financing strategy of projects (through green loans) for the transition to a new energy model based on the use of renewables, high energy efficiency and net-zero greenhouse gas emissions (sustainable finance) will contribute to meeting the goals for limiting global warming, adapting to the changing climate and strengthening resilience.

# 4 SUSTAINABILITY AND CLIMATE ACTIVITIES OF THE BANK OF GREECE IN 2021

# 4.1 Establishment of a Centre for Climate Change and Sustainability, and the Bank of Greece's climate pledge

On 14 June 2021, the General Council of the Bank decided to establish a special business area, the Centre for Climate Change and Sustainability, whose main tasks are: to design, coordinate, support and implement the climate and sustainability activities of the Bank and of the Climate Change Impacts Study Committee (CCISC); to provide recommendations to the Administration on the Bank's climate and sustainability strategy and to support the Bank's highlevel representation at relevant Eurosystem and international fora; and to advise the Bank's Departments on climate and sustainability considerations to be further incorporated into their individual operations (see the Management Report and the Environmental Report 2021).

On 3 November 2021, in the context of the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 26), the Bank of Greece made a pledge to contribute, within its field of responsibility, to the Objective in Article 2.1(c) of the Paris Agreement, Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. This pledge supports the Glasgow Declaration of the Network for Greening the Financial System (NGFS) and the European Central Bank (ECB) pledge on climate change action that were published earlier on the same day; the latter was a follow-up to the ECB's action plan presented on 8 July 2021 to include climate change considerations in its monetary policy strategy (see Section 1 above). Through its COP 26 pledge, the Bank of Greece committed to concrete actions within its field of responsibility, including conducting re-

search; assessing the financial system's exposure to climate-related physical and transition risks; exploring ways to embed the outcome of research and analysis and the available tools and methodologies in macroeconomic forecasting models, financial stability monitoring and supervisory approaches (see Box X.3). It also committed to apply sustainable and responsible investment principles in its non-monetary policy portfolios, in line with the common stance of the Eurosystem.

### 4.2 "LIFE-IP AdaptInGreece – Boosting the implementation of adaptation policy across Greece" project (2019-2026)<sup>42</sup>

The LIFE-IP AdaptInGR project, aimed to boost the implementation of Greece's National Climate Change Adaptation Strategy (NCCAS) (which was drafted by the CCISC and, following public consultation, was enacted by articles 42-45 of Law 4414/2016) brings together, during the current first adaptation policy cycle (2016-2025), the Bank of Greece and 17 other strategic partners from central government, local and regional authorities and the academia. During the first phase of the project (2019-2020), the methodological framework for monitoring adaptation actions and policies was finalised, benefiting from the expertise of the Bank of Greece, and a first assessment was carried out of the project's social and economic impact and contribution to the implementation of the NCCAS.

Currently, monitoring and evaluation work is underway and, jointly with private-sector stakeholders and social partners, public awareness activities are being carried out. Meanwhile, selected adaptation pilots are being rescheduled, after revisions to the initial planning owing to COVID-19 restrictions.

As part of its involvement in the current phase of the project, the Bank of Greece, among other things:

 – contributes to the development of the methodological framework for monitoring the socioeconomic impact of the project's implementation;

 updates its studies on the economic, social and environmental impacts of climate change in Greece;

 helps boost climate change adaptation in the financial sector, by setting up working groups bringing together the banking and insurance industries;

 participates in dissemination of research results and in adaptation awareness and stakeholder engagement activities;

- monitors and assesses the results of project actions; and

 participates in the project's Complementary Funding Committee, which aims to mobilise additional resources for adaptation action in Greece.

# 4.3 The "Economy and Climate: Handle with care" exhibition at the Museum of the Bank of Greece

Given that climate change has consequences for their primary objective of price stability, as well as for their financial stability mandate, central banks too should take urgent action (alongside governments that are primarily responsible for dealing with this matter). Accordingly, the ECB and the Bank of Greece have made their respective pledges on climate action (see Section 4.1 above).

<sup>42</sup> For more details, see https://www.adaptivegreece.gr/en-us/.

In the same vein, since 8 December 2021, the Bank's Centre for Culture, Research and Documentation has been holding a temporary exhibition at the Museum of the Bank of Greece entitled "Economy and Climate: Handle with care". The exhibition describes the phenomenon of climate change and analyses its economic consequences, with a focus on Greece. At the same time, it aims to highlight the risks and opportunities arising from climate change, but also the role of central banks in addressing the impacts of climate change within their mandate.

# 4.4 Memorandum of Understanding between the Bank of Greece and the Ministry of National Defence

On 2 March 2022, the Bank of Greece and the Ministry of National Defence signed a Memorandum of Understanding on cooperation in addressing the impacts of climate change and enhancing the Ministry's relevant capabilities. The two parties agreed to support the climate initiatives and actions of the Ministry, drawing on the expertise of the Climate Change Impacts Study Committee (CCISC). Also, they considered a possible joint participation in national-scale projects aimed at promoting adaptation and strengthening resilience to climate change; to this end, they agreed to work together in designing a number of actions, which could include: collection, analysis and dissemination of environmental data on the evolution of climate changerelated phenomena and biodiversity trends; an assessment of climate change risks and implications for the Armed Forces; information campaigns to raise awareness of climate change mitigation and adaptation; and making more widely known the results of their cooperation.

#### Box X.4

### **GREEN FINTECH**

Achieving the goals of the European Green Deal for sustainable growth and net-zero greenhouse gas emissions by 2050 creates new opportunities as well as challenges because of the substantial additional investment needed. Green finance can foster investment in green innovative projects, thus supporting both the transition to a low-carbon economy and digital transition.<sup>1</sup> The 26th UN Climate Change Conference of the Parties (COP26) in 2021 brought together world leaders and climate experts to agree on the measures needed to tackle climate change and keep temperature increase ideally below 1.5°C. As highlighted by the COP26 objectives and conclusions, there is a clear link between sustainable finance and technological innovation.<sup>2</sup> While the Action Plan on Financing Sustainable Growth<sup>3</sup> and the Action Plan on Fintech<sup>4</sup> have been developed as separate initiatives, the European Commission, in its Strategy for Financing the Transition to a Sustainable Economy,<sup>5</sup> has highlighted the need to seize the opportunities offered by digital technologies for sustainable finance. In 2018, the G20 Sustainable Finance Study Group examined the potential benefits of applying digital technology on sustainable finance.<sup>6</sup>

#### Green financial technology

Green financial technology (green fintech) is defined as "technology-enabled innovations applied to any kind of financial processes and products all while intentionally supporting Sustainable Development Goals or reducing sustainability risks".<sup>7</sup> The application of digital technologies in green finance is perceived as beneficial for its po-

<sup>1</sup> See also Box 29.

<sup>2</sup> The global debate on how emerging technological innovations could be used to support green finance started in 2014, when the United Nations Environment Programme (UNEP) launched the "Inquiry: Design of a Sustainable Financial System". In 2016, green finance was very much under the radar of G20 leaders, with the launch of the Green Finance Study Group during China's G20 presidency.

<sup>3</sup> https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52018DC0097.

<sup>4</sup> https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018DC0109.

<sup>5</sup> https://eur-lex.europa.eu/resource.html?uri=cellar:9f5e7e95-df06-11eb-895a-01aa75ed71a1.0001.02/DOC\_1&format= PDF.

<sup>6</sup> See https://g20sfwg.org/wp-content/uploads/2021/06/G20\_Sustainable\_Finance\_Synthesis\_Report\_2018.pdf.

<sup>7</sup> For green fintech taxonomy, see https://www.greenfinanceplatform.org/sites/default/files/downloads/resource/GreenFintechTaxonomyDataLandscaping-v5%20.pdf.

tential to make large amounts of data available at a lower price and at a fast pace, improving the pricing of environmental risks and opportunities, reducing search costs for information as well as improving the measuring and tracking of sustainability criteria. In such a way, green fintech facilitates access to sustainable finance options, unlocks new sources of finance and enables new business models.<sup>8</sup> For example, the use of blockchain for the automation of processes in bond issuance, although not yet widely adopted, has the potential to reduce the costs of design and financing of green bonds. Big data, machine learning and artificial intelligence would allow the collection from disparate sources, processing of large amount of data about companies' social and environmental impacts as well as translation into more standardized and comparable data for investment decision-making.<sup>9</sup> These digital technologies are already being used by organisations in disaster risk management.<sup>10</sup> Blockchain technology allows also the greenness of investments to be verified in a secure and transparent manner, increasing confidence and lowering costs associated with green labelling. Fintech solutions facilitate access to green finance for start-ups, e.g. through peer-to-peer (P2P) solutions. "Green" crowdfunding platforms enable investors to directly participate in the financial system unlocking new sources of sustainable finance.

Fintech can be considered in part as a more environmentally friendly alternative to the traditional financial sector. For example, cloud computing technologies, in addition to consumer benefits such as increased convenience and more clarity in personal finance management, can contribute considerably to reducing the carbon footprint through energy savings. In addition, as the average consumer is growing more environmentally conscious, some fintech companies seize the opportunity to invest in green initiatives to grow their market share and give a strong incentive to investors who are willing to allocate resources to projects aligned with the relevant sustainability goals.<sup>11</sup> The fintech sector continues to grow rapidly<sup>12</sup> and to make considerable efforts to become "greener".<sup>13</sup> However, it should be noted that the use of digital technologies, such as artificial intelligence and blockchain, implies a high carbon footprint.<sup>14</sup> The European Commission has stressed that while digital technologies are important in the transition process, there are concerns about the environmental impact and growing energy needs of data centres and distributed ledger technology, especially as regards crypto-assets.<sup>15</sup> Furthermore, regulators and supervisors, in cooperation with central banks, should establish the appropriate framework to ensure the safety and protection of users, the financial system and the economy, in line with sustainable development goals and the transition towards an economy with net-zero greenhouse gas emissions.

#### **Conclusions and challenges**

Digital transformation and climate neutrality are the two mega-trends that will shape our future. The challenges that are related to leveraging the full potential of digital finance to mobilize sustainable finance include, among other things, the high energy footprint of digital technologies, the weak digital infrastructure as well as the high costs of newer technologies, the quality and use of sustainability-related data for financial decision-making, the limited awareness and understanding of sustainable digital finance. There is a need to further understand the interaction of sustainable finance, which is a relatively new concept, with digital finance, which is rapidly changing. The effective use of fintech products and services requires, *inter alia*, high levels of digital financial

15 https://eur-lex.europa.eu/resource.html?uri=cellar:9f5e7e95-df06-11eb-895a-01aa75ed71a1.0001.02/DOC\_1&format= PDF.

<sup>8</sup> https://g20sfwg.org/wp-content/uploads/2021/06/G20 Sustainable Finance Synthesis Report 2018.pdf.

<sup>9</sup> The interest in sustainable financial products has led the largest credit rating agencies to revise methodologies and establish credit rating standards to incorporate climate and environmental risks. It is therefore necessary for investors to have reliable and comparable data in order to make informed decisions on environmental risks. See Bank of Greece, *Monetary Policy Interim Report* 2021, Box VII.2.

<sup>10</sup> The World Bank uses machine learning techniques in its disaster management strategy: https://documents1.worldbank.org/ curated/en/503591547666118137/pdf/133787-WorldBank-DisasterRiskManagement-Ebook-D6.pdf.

<sup>11</sup> For example, by planting trees and funding projects related to clean energy and solar energy, etc. See, *inter alia*, https://www.finextra.com/blogposting/20197/the-5-green-fintechs-you-need-to-watch-in-2021.

<sup>12</sup> In the first half of 2021, global fintech investment reached USD 98 billion through 2,456 agreements. See KPMG, Pulse of Fintech H1 2021.

<sup>13</sup> Further digital transformation and delivering the sustainable development goals are the two top trends in the financial sector for 2022. See Capgemini (2022), *Top Trends in Banking* 2022 (eBook).

<sup>14</sup> See Alonso, A. and J.M. Marqués (2019), "Financial Innovation for a Sustainable Economy", Banco de España, *Documentos Ocasionales*, No. 1916.

literacy.<sup>16</sup> At the same time, the European Commission and the OECD have stressed the need to promote shared understanding of the financial competences individuals need in order to make sound decisions on personal finance while also supporting sustainability.<sup>17</sup> As regards Greece, there is a strong digital divide, with significant socioeconomic differences in access to and use of digital technologies. It is therefore necessary to set up a system of continuous education and training. Moreover, investment in innovation and infrastructure is required for Greece to become a technology hub.<sup>18</sup>

<sup>16</sup> In 2016, leaders endorsed the high-level principles on digital financial inclusion, which involved the strengthening of digital and financial education and awareness raising. See GPFI (2016), "G20 High-Level Principles for Digital Financial Inclusion, Global Partnership for Financial Inclusion". Moreover, the European Commission has recognised the importance of financial literacy for consumers in the context of their greater participation in the capital market and for small- and medium-sized enterprises in the context of the Capital Markets Union. See European Commission (2020), A new Vision for Europe's capital markets: Final Report of the High-Level Forum on the Capital Markets Union.

<sup>17</sup> For example, individuals should understand and take into account the environmental impacts of their purchases, be able to assess sustainable investments, identify cases of greenwashing, climate-related risks and sustainability labels. See also European Union/OECD (2022), "Financial competence framework for adults in the European Union".

<sup>18</sup> See Bank of Greece, Annual Report 2020, Box X.3, for further analysis of the factors that may fuel the risk of technological lags in Greece.