

CLIMATE-RELATED DISCLOSURES BY THE DEUTSCHE BUNDESBANK 2023

Part of the Eurosystem-wide climate-related disclosures on the non-monetary policy portfolios (NMPPs)

CONTENT

| | |
|--|-----------|
| Summary | 4 |
| 1. Foreword | 6 |
| 2. Governance..... | 8 |
| 3. Strategy | 11 |
| 3.1 Climate risk committee work | 11 |
| 3.1.1 International bodies..... | 11 |
| 3.1.2 National bodies..... | 13 |
| 3.2 Eurosystem action plan to incorporate climate change considerations into monetary policy framework..... | 14 |
| 3.3 Climate data..... | 16 |
| 3.4 The Bundesbank as fiscal agent | 17 |
| 3.5 Sustainable investment strategy for the euro portfolio | 18 |
| 3.6 Sustainable investment strategy for foreign currency reserves as part of foreign reserve assets | 19 |
| 4. Risk management..... | 22 |
| 5. Metrics and targets..... | 24 |
| 5.1 Euro portfolio..... | 25 |
| 5.1.1 GHG metrics | 25 |
| 5.1.2 Green and brown shares of business activities | 29 |
| 5.1.3 Negative screening for breaches of international standards and involvement in controversial weapons | 30 |

| | | |
|---------|---|-----------|
| 5.2 | Foreign reserve assets | 30 |
| 5.2.1 | Supranational and agency bonds in the foreign reserve assets | 32 |
| 5.2.1.1 | GHG metrics | 33 |
| 5.2.1.2 | Green and brown shares of business activities | 33 |
| 5.2.1.3 | Negative screening for breaches of international standards and involvement in controversial weapons | 33 |
| 5.2.2 | Sovereign and sub-sovereign investments in the foreign reserve assets | 34 |
| 5.2.2.1 | GHG metrics | 36 |
| 5.2.2.2 | Production volumes of fossil fuels. | 38 |
| 5.3 | Targets and outlook | 38 |
| | Annex: Methodology for GHG metrics used | 40 |
| I. | Methodology for GHG metrics relating to corporations | 40 |
| II. | Methodology for GHG metrics relating to sovereigns and sub-sovereigns | 42 |

SUMMARY

The Bundesbank's climate-related report for 2023 brings its disclosures into alignment with the Eurosystem's harmonised reporting methods and procedures. This new report updates and expands upon last year's disclosures by incorporating current issues. The present document is again structured around the recommendations by the Task Force on Climate-related Financial Disclosures (TCFD), which comprise four pillars: (i) governance, (ii) strategy, (iii) risk management, and (iv) metrics and targets.

To coordinate and steer the Bank's climate-related activities with a maximum of efficiency, the Bank is establishing a new central sustainability unit that will report directly to the Executive Board. The Green Finance Steering Committee provides overarching strategic impetus and serves as a knowledge transfer and reporting forum for management and the Executive Board.

Strategic input is also provided by the Bundesbank through its work in international and national bodies. In addition, it takes climate change considerations into account in the management of its non-monetary policy portfolios. Having already introduced a sustainable investment strategy for the euro portfolio, the Bank has now also adopted a sustainable investment strategy for the foreign currency reserves held as part of its foreign reserve assets.

The consequences of both climate change and climate policy can be a source of financial risks to the Bank's own balance sheet, which is why the Bundesbank's Risk Control Division regularly analyses these risks, including for the Bank's non-monetary policy investments. One aspect of this analytical work, disclosed in this report, is the measurement of greenhouse gas (GHG) emissions and other climate-related metrics.

The Bundesbank's calculation of GHG metrics for its portfolios is geared towards the recommendations of the TCFD and the Partnership for Carbon Accounting Financials (PCAF). That means computing, amongst other metrics, the weighted average carbon intensity (WACI), the carbon footprint, and the total carbon emissions of the securities held in the Bank's proprietary portfolios. The weighted average carbon intensity of the Bank's

euro portfolio amounts to 1.43 tonnes of CO₂ equivalents (CO₂e) per million euro of gross income, down slightly on the previous year's level of 1.49 tonnes. Also slightly lower on the year is the carbon footprint, which dropped to 0.16 tonnes of CO₂e per million euro of investment. Total carbon emissions are being disclosed for the first time. In 2022, these came to 1,181 tonnes of CO₂e for the euro portfolio, 264 tonnes of CO₂e less than in the previous year due to the lower level of portfolio holdings.

The measured values are comparatively low overall because of the structure of the Bundesbank's euro-denominated proprietary portfolio, which consists entirely of covered bonds issued by banks. The metrics presented in this report cover only GHG emissions owned or controlled by the banks (i.e. the covered bond issuers) (scope 1 and 2). Some improvement is evident in the data situation for GHG emissions financed by the banks via their investments and/or loans (scope 3), but quality and coverage issues remain. As the data situation improves and allows the financed GHG emissions to be accounted for, the climate-related metrics calculated for the euro portfolio are likely to be significantly higher.

The Bundesbank's foreign reserve assets comprise, amongst other things, assets related to sovereigns (primarily US Treasuries) and sub-sovereigns (for example, bonds issued by federal states or provinces). Compared with their global averages, the climate-related metrics here indicate that GHG emissions and coal production volumes are lower, but crude oil and natural gas production volumes are higher relative to the size of the economy. The foreign reserve assets furthermore comprise bonds issued by supranational and national promotional and development banks, with a green share of around 18%. This is mainly because green financing often constitutes a considerable share of the business activities of such issuers (e.g. financing of renewable energy and public transport).

1. FOREWORD

The Bundesbank published its first [climate-related disclosures](#) in July 2022. That document saw the Bank report in detail, for the first time, on its activities surrounding climate change considerations and disclose climate-related metrics for the euro portfolio – that is, the Bundesbank’s proprietary euro-denominated non-monetary policy portfolio (NMPP). This second report now brings the Bundesbank’s climate-related disclosures into alignment with the Eurosystem’s harmonised methods and procedures, as well as the common reporting cycle. The beginning of 2021 saw the Eurosystem agree on a common stance for climate change-related sustainable and responsible investment principles for the euro-denominated non-monetary policy portfolios of the Eurosystem central banks. One aspect of this common stance is climate-related disclosure. Disclosures should be structured around the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) and its four pillars: (i) governance, (ii) strategy, (iii) risk management and (iv) metrics and targets, with the fourth pillar being covered as a minimum. It was agreed that annual disclosures of climate-related information on euro-denominated NMPPs would begin in the first quarter of 2023 at the latest.

Climate change and climate policy touch upon almost all core central bank tasks. This insight prompted the Bank to identify “sustainability” as one of four megatrends back in 2020 as part of its in-house strategy review, and led to strategic objectives relating to specific business areas being fleshed out to address this topic. One such initiative as part of [Strategy 2024](#) saw the Bank strengthen its analytical capabilities, particularly in the field of climate change. The new capacities needed for this across all the relevant areas of the Bank were created towards the end of 2019. Given that climate change considerations and climate-related financial risks, too, have a bearing on the performance of its core tasks, the Bank is striving, within its mandate, to play a part in boosting market transparency surrounding the risks and financial implications of climate change. Furthermore, the Bundesbank is aiming to promote greater awareness and understanding of climate-related risks in the financial sector as a whole, seeing itself as a catalyst for sustainable change within the financial system.

Section 2 shows how internal governance is structured with respect to climate-related risks and opportunities and outlines the Bank’s current thinking on anchoring climate

protection and sustainability issues to even greater strategic effect within its broader governance structure. There is also an account of the Bundesbank's efforts in the national and global arena to combat climate change and its financial consequences, and details are provided on strategies for incorporating climate-related criteria into portfolio management. For the first time, the Bundesbank is also disclosing its strategy for its foreign reserve assets.

It is important for a central bank to take into account that climate risks are financial risks, too. How the Bundesbank incorporates these risks into its risk management is explained in the relevant section dealing with risk management. Alongside updated disclosures of climate-related metrics for the euro portfolio, Section 5 also presents, for the first time, metrics for the foreign reserve assets (specifically, the foreign currency portion thereof). This report thus covers each of the four core thematic areas recommended for disclosure by the TCFD.

2. GOVERNANCE

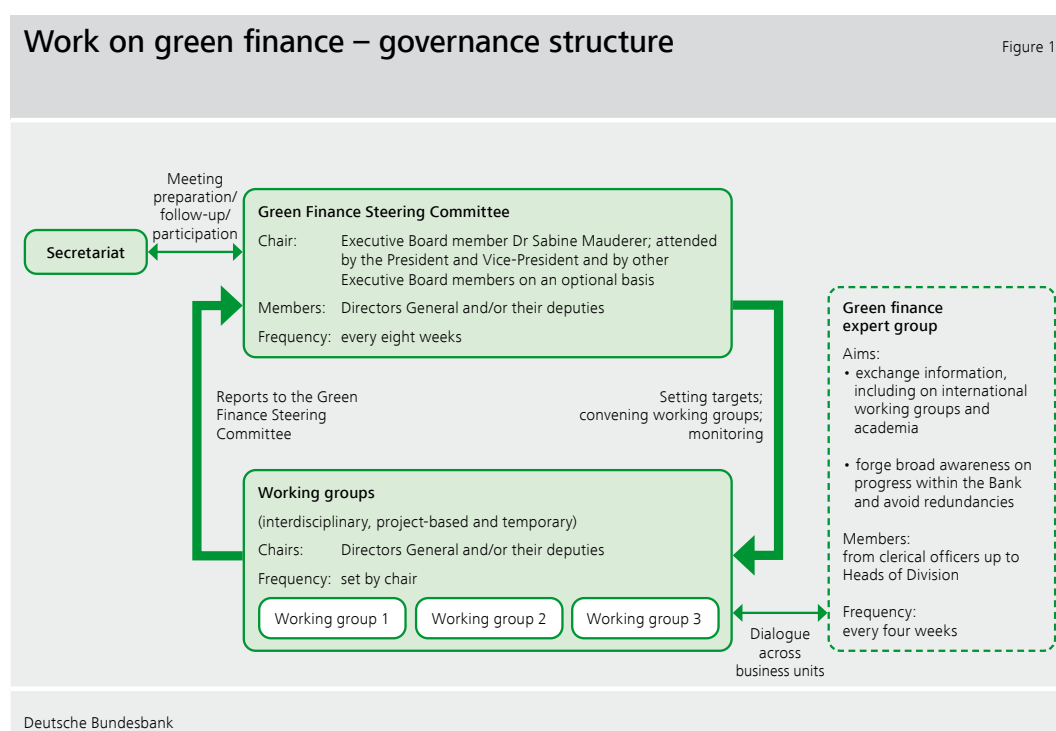
As a way of coordinating and steering work throughout the Bundesbank on the repercussions of climate change and climate policy to even greater effect, both internally and externally, the Bank is establishing a new central strategy unit that will take charge of the overarching topic of sustainability across the institution. Anchored directly below the Executive Board in organisational terms, this new unit will be a hub for questions, projects and analytical work relating to climate risks and the consequences of climate change. It will also serve as the main contact point for the general public, provide subject matter support and strategic advice for the Executive Board, and continually evolve the Bundesbank's position on this topic. This marks the natural next step for the Bundesbank towards ensuring that the great importance of sustainability as a topic is now also reflected in an appropriate and future-proof manner in the Bank's organisational and internal governance framework.

This move comes after the creation of the Green Finance Steering Committee back in 2021 to coordinate the work programme on climate risks, set a uniformly high level of ambition across the Bank as a whole and provide strategic impetus. Chaired by Executive Board member Dr Sabine Mauderer, this committee convenes roughly every eight weeks. Every second meeting is attended by the Bank's President and Vice-President, while other Executive Board members are regular participants in meetings as well. Management-level representatives from numerous business units also attend committee meetings.¹ The committee uses working groups made up of staff members from different business units to handle specific climate or sustainability-related projects. One or two business units generally lead each of these working groups, meaning they organise and monitor work flows, define priority topics and ensure that work advances as scheduled. The heads of each working group report regularly to the Executive Board members in attendance at the meetings of the Green Finance Steering Committee. This set-up ensures that projects are subject to ongoing monitoring.

¹ Banking and Financial Supervision, Financial Stability, Research Centre, Communications, Markets, Legal Services, Risk Control, Statistics and Economics.

The Green Finance Steering Committee is flanked by a green finance expert group, which is a forum for regular expert-level interaction and dialogue across the Bank. This expert group sets out to facilitate a broad exchange of information on work ongoing within and outside the Bank, promote interdisciplinary networking across the institution and prevent the duplication of work. Figure 1 sketches out the structure of the Green Finance Steering Committee. The new central sustainability unit mentioned above acts as the Green Finance Steering Committee’s secretariat and agenda-setter.

In addition, the business units are responsible for flagship projects of their own and prepare quarterly progress reports. These quarterly meetings also see the Green Finance Steering Committee advise on the priorities and relevance of such work, provide leadership and guidance for ongoing projects, and offer impetus and inspiration for possible new projects.



The existence of the Green Finance Steering Committee ensures that various business units across the Bank are well-informed about the many different activities and are networked internally, while the Executive Board remains in the loop about the wide range of activities and has the opportunity to provide input as necessary. This way, the analyses and projects in the various business units can be steered with precision by the Executive Board members.

Climate-related work at the Bundesbank is very broad-based. To analyse the macroeconomic repercussions of climate change and climate policy, the Bank modifies pre-existing instruments and also deploys new models with a view to assessing the sectoral repercussions

of climate-related risks and analysing policy-driven adjustment processes over time – not least in an international context, e.g. with regard to climate clubs or climate tariffs. The Bank furthermore investigates the impact of firm-level GHG emissions on financial markets.

Climate change also features in the Bundesbank's research programme as an overarching subject area: macroeconomic modelling is being used to examine, in particular, the effects of heterogeneities across households, enterprises or countries. Financial market research is looking at developments in new markets for sustainable financial products and their implications for financial stability and regulation. In banking supervision, the Bundesbank is committed to ensuring that institutions integrate climate risks into their risk management, business and risk strategy, corporate governance and business organisation. At the same time, a framework needs to be established to ensure that information on climate risks is disclosed and to increase market transparency in the credit sector. In addition, the Bundesbank is working on a climate risk stress test to assess the vulnerability of individual financial institutions and of the entire German banking sector to climate risks. Furthermore, a cross-sector carbon price stress test for the entire German financial system is intended to allow the overall resilience of the German financial system to be assessed.

3. STRATEGY

Addressing climate change is a global challenge, so it is not just a question of what the Bundesbank itself can do, within its mandate, to tackle climate change. Indeed, the success of these efforts often also hinges on collaborating effectively with others. The envisaged central strategy and steering unit will improve and expand cooperation not only within the Bank but externally as well. The Bundesbank breathes life into this collaborative strategy by stepping up its involvement as an institution at many levels and in various bodies – in Germany, at the European level and worldwide. At the same time, the Bundesbank also takes its responsibilities seriously as far as its own financial investments and the environmental footprint of its business operations are concerned. This is why the Bundesbank not only considers sustainability criteria in its euro portfolio but also, at the beginning of 2023, adopted sustainability criteria for the foreign currency reserves held as part of its foreign reserve assets.

3.1 Climate risk committee work

3.1.1 International bodies

Network for Greening the Financial System (NGFS)

More and more central banks around the world are becoming aware of their responsibilities in terms of what climate change means for the fulfilment of their mandates and they are taking these responsibilities seriously. This is why an increasing number of them are aligning their activities with climate-related considerations. The Bundesbank is one of the founding members of the Network for Greening the Financial System (NGFS), which now brings together over 140 central banks and supervisory authorities worldwide. The NGFS is pushing to make the financial system more sustainable. Its goal is to analyse the implications of climate change for the financial system and tilt global financial flows towards climate-friendly, environmentally sustainable economic growth in a way that helps to achieve the Paris Climate Agreement targets. The NGFS thus makes a valuable contribution, not only

to the activities of central banks and supervisory authorities, but also to the global debate on the impact of climate change on the economy and financial markets and to the further development of common standards. Besides facilitating expert-level analysis, the network mainly serves as a platform for sharing best practices for identifying climate-related financial risks and improving the way they are managed. It also explores ways to promote the consideration of sustainability aspects as a factor in investment decisions and to thus play a part in establishing the most uniform possible global standards.

The Bundesbank is contributing expertise at various levels to the work of the NGFS. A long-standing member of the NGFS Steering Committee, Bundesbank Executive Board member Dr Sabine Mauderer has been serving as Vice-Chair of the NGFS since the beginning of 2022, making her a key player in defining the network's strategic focus. At the beginning of 2024, Dr Mauderer will take over as Chair of the NGFS for a two-year term. This new role underlines the Bundesbank's intention, within its mandate, to make even more of a contribution to the debate on incorporating climate change considerations into the range of tasks performed by central banks and, above all, into its own actions going forward. The Bundesbank was already providing valuable input for the network's activities even before Dr Mauderer was appointed NGFS Vice-Chair, having been responsible for the NGFS workstream Scaling up green finance, which ran until April 2022, again under Dr Mauderer's leadership.

In May 2022, the NGFS launched its new work programme, which aims to improve scenario analysis and macroeconomic modelling of climate risks by April 2024. Other areas of focus include transition planning, biodiversity-related risks and knowledge transfer. Work is also advancing on the interaction between monetary policy and the consideration of climate criteria as well as the climate-related disclosure standards. September 2022 saw the Bundesbank host a regional European meeting of the NGFS in Frankfurt am Main in an event that was attended by more than 60 guests. A meeting of the NGFS Steering Committee was also held in Frankfurt. Last but not least, the NGFS played a prominent role at the UN Climate Change Conference in Egypt (COP27), where it hosted a number of workshops of its own. The Bundesbank was thus once again instrumental in helping the NGFS boost its visibility and standing in 2022.

The NGFS celebrated its fifth anniversary in December 2022. Since its inception in 2017, the network has grown to become an important global forum that will continue to help central banks and supervisors rise to the challenges of the sustainable transformation.

German G7 Presidency

Germany held the G7 Presidency in 2022. The Bundesbank and the Federal Ministry of Finance jointly prepared the agenda for the G7 Finance Track, which is the workstream of the finance ministries and central banks.

This Finance Track saw the creation of a G7 Working Group on Climate Change Mitigation, which started its work under the German Presidency. The central banks and finance ministries of the G7 countries as well as global institutions are making major contributions to this working group with the aim of achieving global comparability across different climate policies and reduction paths. It is also looking to strengthen the analytical capabilities needed to gain a clearer understanding of how climate action impacts key macroeconomic and financial variables and interpret them better using more sophisticated methodologies.

A prerequisite for this analytical work is the existence of sufficient, informative climate data to conduct a meaningful assessment of risks that climate change presents to the financial system. Numerous regulatory disclosure requirements in the years ahead will produce an increasing flow of new data. One of the challenges in this respect will be to establish clear, consistent and comprehensible ways of processing and providing these data. The Bundesbank is supporting efforts, including in the G7, to improve access to climate data. In this regard, it advocates building up and maintaining an online NGFS directory for climate data, amongst other things.

Membership of the Eurosystem Climate Change Forum

In July 2022 the ECB Governing Council approved the establishment of a new Eurosystem Climate Change Forum and its mandate. This (voluntary) association of national central banks serves as a vehicle for fostering information exchange and knowledge sharing at the Eurosystem level and for coordinating topics and projects relating to climate risks and the impact of climate change on central banks' activities. The new forum was established to leverage Eurosystem expertise and thus also to support joint efforts to press ahead with the Eurosystem's climate agenda. As a forum member, the Bundesbank plays an active role in the forum's discussions and contributes to its work. Sustainability and climate risks thus represent further areas in which cooperation within the Eurosystem is crucial to advancing the Eurosystem's common climate agenda.

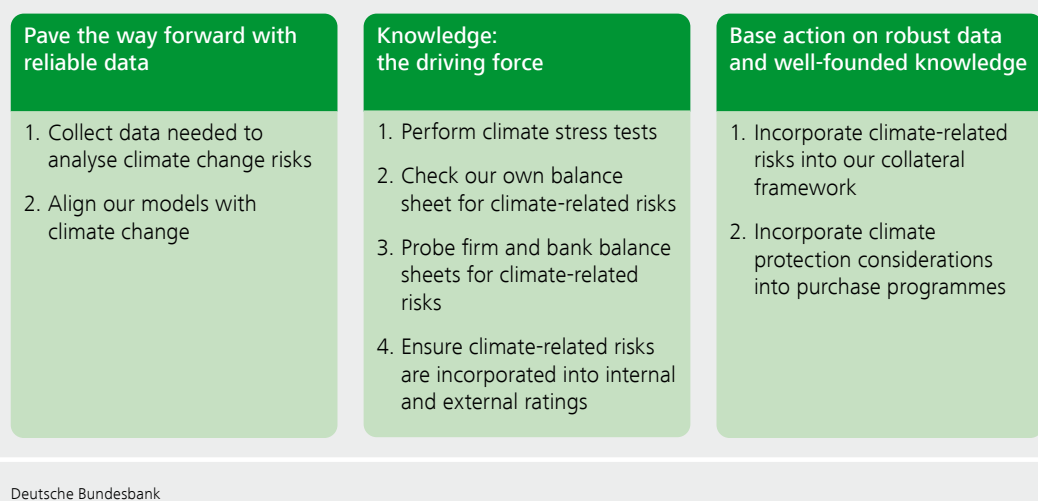
3.1.2 National bodies

The Bundesbank has been a permanent observer of the Federal Government's [Sustainable Finance Committee](#) (SFC) since the committee's early days. By playing a constructive role in the SFC's discussions and negotiations, the Bank has helped lay the foundations for Germany's Sustainable Finance Strategy, which was built around the SFC's [final report](#). The SFC is continuing its work under the current Federal Government, and the Bundesbank remains a committee member, providing advisory services for the relevant institutions on the SFC to make Germany a leading centre for sustainable finance in keeping with its commitment to preserving financial stability.

There is another national forum – the [Green and Sustainable Finance Cluster Germany](#) (GSFCG) – of which the Bundesbank has been a member for far longer. As the main platform for dialogue and cooperation among private and public market participants on the topic of sustainable finance in Germany, the GSFCG pools resources, facilitates the exchange of views and best practices, produces its own assessments and opinions, offers training courses and organises expert-level dialogue for the German financial centre.

3.2 Eurosystem action plan to incorporate climate change considerations into monetary policy framework

Being part of the Eurosystem, the Bundesbank, alongside the other Eurosystem central banks, plays a part in implementing the ECB Governing Council’s landmark strategy decision of July 2021. This decision underlines a commitment to more systematically reflect environmental sustainability considerations in monetary policy implementation, in line with the specific Eurosystem mandate enshrined in the EU Treaties. The aim is to gradually implement this decision together with the other central banks of the Eurosystem. This is another mission the Bundesbank is working on with a great deal of commitment through its active involvement in the relevant Eurosystem working groups. The ECB Governing Council’s decision was one outcome of the Eurosystem’s monetary policy strategy review concluded in the summer of 2021. That review saw the Eurosystem central banks – and thus the Bundesbank as well – acknowledge that combatting climate change is a global challenge. One aspect of the new strategy is an action plan that will see climate change considerations and implications being incorporated, within the mandate, into the Eurosystem’s monetary policy framework. The chart below illustrates the main areas of action in this action plan:



Building on analytical preliminary work, the ECB Governing Council adopted further concrete steps in the summer of 2022 to include climate change considerations in the Eurosystem’s monetary policy framework. These aim in particular to better manage and minimise climate-related financial risks on the Eurosystem’s balance sheet. Moreover, the measures provide incentives to enterprises and financial institutions to be more transparent about their GHG emissions and to reduce them, thereby supporting the green transition of the economy.

The Governing Council decided on the following measures in July 2022:

- **Corporate bond holdings in the Eurosystem’s monetary policy portfolios (CSPP):** The Eurosystem aims to gradually decarbonise its corporate bond holdings so as to mitigate climate-related financial risks on the Eurosystem balance sheet, in particular, on a path aligned with the goals of the Paris Agreement. To that end, the Eurosystem central banks will tilt these holdings towards firms with a better climate performance through the reinvestment of the redemptions. Climate performance will be measured with reference to GHG emissions, GHG reduction targets and climate-related disclosures.² This way, incentives are provided for issuers to improve their disclosures and reduce their GHG emissions in the future. This measure has been operational since October 2022. Furthermore, in combination with climate-related disclosures by the Eurosystem central banks on their non-monetary policy portfolios, the Eurosystem will, as of the end of March 2023, start publishing climate-related information on corporate bond holdings in the monetary policy portfolios on a regular basis.

² The Eurosystem published further details on how this measure is being implemented in September 2022: <https://www.ecb.europa.eu/press/pr/date/2022/html/ecb.pr220919-fae53c59bd.en.html>

- **Collateral framework:** The Eurosystem will limit the share of assets issued by entities with a large GHG footprint that can be pledged as collateral by individual counterparties when borrowing from the Eurosystem. The new limits regime aims to reduce climate-related financial risks in Eurosystem credit operations as well (this applies only to marketable debt instruments issued by corporations outside the financial sector, at first). This measure is expected to apply by no later than the end of 2024 provided that the necessary technical preconditions are in place. To encourage banks and other counterparties to prepare early, the Eurosystem will run tests of the limits regime ahead of its actual implementation. In any case, the Eurosystem will, however, ensure that sufficient collateral remains available, allowing monetary policy to continue to be implemented effectively.
- **Climate-related disclosure requirements for collateral:** The Eurosystem will only accept marketable assets and credit claims from corporations and debtors that comply with the Corporate Sustainability Reporting Directive (CSRD) as collateral in Eurosystem credit operations (once the directive is fully implemented). These new eligibility criteria are therefore only likely to apply as of 2026.
- **Risk assessment and management:** The Eurosystem is continuously enhancing its risk assessment tools and capabilities to better include climate-related risks. In particular, the Eurosystem agreed on a set of common minimum standards for how national central banks' in-house credit assessment systems should include climate-related risks in their ratings. These new minimum standards will enter into force by the end of 2024.

The ECB Governing Council will regularly review the measures adopted, assess their effects and adapt them, if necessary. In addition, it will respond to future improvements in climate data and climate risk modelling or changes in regulation.

Furthermore, it intends, within its mandate, to consider more steps in the future to gradually implement the Eurosystem's common climate agenda.

3.3 Climate data

The successful procurement of two dedicated providers of climate-related data by the Bundesbank laid the foundations for climate-related disclosures throughout the Eurosystem. It means that all the central banks that belong to the European System of Central Banks (ESCB) are now able to access these newly procured climate-related data. Use of a common

set of data and harmonised calculation methods throughout the Eurosystem means that it is now possible to compute comparable portfolio climate-related metrics (see Section 5). These data also lay the groundwork for the disclosure of potential climate-related financial risks not only in the corporate sector purchase programme (CSPP) but also, going forward, for additional monetary policy portfolios or other Eurosystem tasks, such as banking supervision. The common set of data means that Eurosystem central banks can produce uniform, transparent and comparable climate-related analyses. The successful climate data procurement procedure led by the Bundesbank was honoured by the member central banks of the Eurosystem Procurement Coordination Office (EPCO) in three categories: “2022 EPCO Most Innovative Procurement”, “2022 EPCO Most Sustainable Procurement” and “2022 EPCO Final Award”.

Though the procurement process is now over, the Bundesbank continues to liaise closely with the data providers to ensure that the data are provided and implemented smoothly. One initiative has seen the Bundesbank’s Sustainable Finance Data Hub set up a forum for sharing best practices on how to make the most of the licensed climate-related data. This voluntary forum is a place where central banks can come together to work on issues in the fields of data collection and documentation and discuss improvements and data processing. Working together and sharing knowledge increases the quality and analytical value of the licensed data, and forges a deeper understanding of them.

3.4 The Bundesbank as fiscal agent

The Bundesbank acts as fiscal agent for Germany’s central and state governments as laid down in the Bundesbank Act (Bundesbankgesetz). In this function, the Bundesbank offers passive or rules-based investment management for equities and bonds in accordance with individual client requirements. For several years now, there has been a sharp rise in client interest in incorporating sustainable investment criteria. The Bundesbank supports its clients with its existing expertise in sustainable investment, especially in the analytical field as well as in developing appropriate concepts and in reporting. A number of clients now use the equity indices of prestigious index providers that are tailored to their sustainability preferences. Climate benchmarks as defined by the EU play an increasingly important role in this, as they support the objectives of the Paris Climate Agreement. The Bundesbank then replicates these indices in the respective portfolios. The Bundesbank now takes sustainability criteria into account in almost all of the 16 portfolios it manages, and increasingly also in the bond area, especially for covered bonds.

3.5 Sustainable investment strategy for the euro portfolio

The Bundesbank addresses (financial) climate-related risks by systematically accounting for them in its own non-monetary policy investments. The first step in this direction was taken last year in the Bundesbank's euro portfolio, which is invested in an effort to improve the risk/reward profile. In accounting terms, this portfolio is a counterpart to the Bank's capital, its statutory reserves and long-term provisions for civil servant pensions and healthcare assistance. It is therefore limited to a certain volume, accounting for only a small share of the Bundesbank's balance sheet.

The euro portfolio consists exclusively of fixed income euro-denominated covered bonds, which are generally held to maturity. These covered bonds are currently purchased from Germany, France, Finland, the Netherlands and Belgium.

Within the scope of its statutory mandate, the Bundesbank is aiming to incorporate sustainability into the management of its euro portfolio, alongside the improvement of earnings, safety and liquidity. Investments in the euro portfolio focus on climate change and the transition to a low carbon economy, with issuers being analysed in terms of their climate-related sustainability profile. The sustainability profile is based on a combination of two metrics for all eligible issuers: Carbon risk rating (CRR) and greenhouse gas intensity, both being provided by the ESG data provider ISS ESG. Those issuers with the best sustainability profile are then overweighted in the benchmark portfolio and the worst are underweighted. In effect, then, a tilting approach is followed.

This strategy also excludes issuers that have committed systematic, serious breaches of globally recognised minimum standards – specifically, the UN Global Compact, the OECD Guidelines for Multinational Enterprises, the ILO core labour standards and international treaties on prohibited weapons. If an issuer breaches these criteria, its securities are excluded from the investable universe. This is done by means of a negative screening of issuers, for which the Bundesbank uses selected ratings from ISS ESG.

The intention is to gradually expand the investment strategy pursued in the euro portfolio and regularly review its suitability. This is also particularly important if the quality of the available data improves to such an extent that bond issuers' greenhouse gas emissions can be assessed more comprehensively.

3.6 Sustainable investment strategy for foreign currency reserves as part of foreign reserve assets

The Bundesbank's foreign reserve assets comprise gold holdings, receivables from the IMF and foreign currency reserves.

Foreign currency investment is made in US dollars, Japanese yen, Australian dollars, Canadian dollars and Chinese renminbi. The majority of this constitutes sovereign bonds. Holdings also include bonds issued by sub-sovereigns (e.g. federal states and provinces) and by supranationals and agencies (generally national or supranational promotional and development banks).

In early 2023, the Bundesbank decided to introduce a sustainable investment strategy for the foreign currency portion of foreign reserve assets in order to take greater account of climate-related financial risks and – where possible without hampering the fulfilment of its currency policy tasks – to combat climate change.

The strategy focuses on the eligibility of issuers. Since restrictions on sovereign bonds (United States, Japan, Australia, Canada and China) are virtually impossible given the overarching currency policy-driven requirements, the Bundesbank has developed suitable approaches for the remaining issuer groups of relevance to its foreign currency reserves (supranationals and agencies; sub-sovereigns).

For purchasing securities issued by sub-sovereigns, the sub-sovereign has to have a better climate profile than the corresponding sovereign. The climate profile is determined by the total greenhouse gas emissions and the volumes of fossil fuels produced in the sub-sovereign region relative to the size of its economy. Thus, in foreign currency investment, the Bundesbank refrains from investing in sub-sovereigns with a worse climate profile than the corresponding sovereign. If a sub-sovereign has a significantly worse climate profile than the corresponding sovereign, the Bundesbank would consider selling the securities holdings in question.

For purchasing bonds issued by supranationals and agencies, minimum requirements in terms of a climate-focused sustainability score are defined. Sustainability scoring for issuers is based on three pillars: 1) green and/or brown shares of business activities; 2) ambition, e.g. with regard to greenhouse gas reduction targets or the exclusion of fossil energy financing; 3) transparency and/or the quality of climate-related disclosures. The results of these three pillars are weighted and combined to form an overall score, with pillar 1

being the main focus of the overall score. In foreign currency investment, the Bundesbank will therefore not invest, in particular, in promotional and development banks which provide a considerable level of funding to sectors that harm the climate and the environment, such as the fossil fuel sector. In addition, sustainability scoring is in line with the Bundesbank's aim of creating an incentive for issuers to set themselves climate goals and to provide climate-related disclosures. If an issuer falls significantly short of the sustainability requirements, a sale is considered.

In addition, as for the euro portfolio, an ongoing negative screening for systematic and serious breaches of globally recognised minimum standards is carried out for supranationals and agencies.

Two sides of the same coin, the Bundesbank's environmentally conscious business operations

The business operations of an institution such as the Bundesbank inevitably have an impact on the environment. The Bank is aware of its responsibility and its function as a role model in minimising its environmental impact and making a lasting contribution to protecting the environment and the climate. GHG emissions serve as the key indicator, which can be directly influenced by organisational or architectural measures. In order to know and improve its own GHG footprint, scope 1 and scope 2 emissions have, since 2013, been recorded in accordance with the Greenhouse Gas Protocol (GHG Protocol) and presented transparently in an annual [Environmental Report](#). Some scope 3 emissions, in particular those arising from unavoidable business travel, are also recorded and accounted for. To convert GHG emissions into CO₂ equivalents (Co₂e), the Bank uses the calculation tool devised by the Verein für Umweltmanagement und Nachhaltigkeit in Finanzinstituten e.V. (VfU), which is being continuously improved. Since the survey was launched, several major and many smaller measures as well as some beneficial external effects have allowed GHG emissions from business operations to be reduced every year up until 2021. Compared with the base year of 2013-14, recorded GHG emissions had already been brought down by 50% in 2021.

In order to ensure that the Bank continues to lower emissions steadily and systematically until it reaches its target of net greenhouse gas neutrality, the Bundesbank's internal environmental management scheme is adapting existing processes and responsibilities in such a way that they comply with the requirements of the European Eco-Management and Audit Scheme (EMAS). The aim of this is to ensure that (ecological) sustainability is anchored even more broadly and deeply in all processes and in staff's awareness. Initially, the Bundesbank's Central Office in Frankfurt and at the nine regional offices throughout Germany will be assessed. After this "pilot phase", the branches, too, are to be fully integrated.

The changeover will also be reflected in environmental reporting. In addition to GHG emissions, the Bundesbank's current environmental guidelines also cover environmental pollution from waste, the use of materials (paper) and resources. For reporting purposes, however, this environmental impact is also converted into CO₂ equivalents. In future, these areas will report their own core EMAS indicators, which can be used as an additional measure of the environmental impact of business operations, irrespective of emissions. Through this multi-dimensional approach arising from the alignment with EMAS requirements the Bundesbank's environmental management system is being developed into a validatable environmental management system that is fit for the future. This will allow environmental pollution to be represented even more transparently and also to be monitored more effectively.

4. RISK MANAGEMENT

The Bundesbank aims to take ever greater account of climate-related risks throughout the entire risk management cycle, i.e. when identifying, analysing, measuring, communicating and managing risks. In organisational terms, this is being implemented using the existing risk management structures: responsibility for the Bundesbank's financial business risks lies with the Risk Control Division, which is segregated from risk-taking market units up to and including the Executive Board level.

From a risk management perspective, the primary focus is naturally on how climate change and climate policy may affect the value of the Bundesbank's balance sheet assets and how the balance sheet can be protected from such effects, should the need arise. Climate-related financial risks comprise not just the effects of climate policy, such as the impact of a carbon tax, but also changes in consumer preferences such as the switch to electric cars (transition risk drivers). These exist alongside the actual repercussions of climate change itself, such as floods, droughts and other extreme weather events, as well as long-term developments, such as rising sea levels (physical risk drivers).

Theoretically, these can be considered separately from the direct or indirect effects of the Bundesbank's business activities in promoting or mitigating global climate change, which the Bundesbank may have to take into account in its planning and decision-making in order to contribute to climate protection within the limits of its own mandate. In practice, the two perspectives often overlap. For example, the GHG metrics outlined in the following section are used both as risk indicators and for measuring climate compatibility. The sustainable investment strategies presented in this report for the euro portfolio and foreign currency reserves held as foreign reserve assets also combine both perspectives.

Ultimately, the Bundesbank would risk public disapproval if it did not attend in any noteworthy way to climate considerations in its own business activities, or even ignored them entirely. This could harm the Bundesbank's reputation, a matter of great importance for a central bank in particular.

The analysis and evaluation of climate-related risks stretches the use of traditional risk models to its limits. These models are based on probability distributions, which are calculated using a longer data history and assuming constant structural relationships. Yet that assumption is problematic given that forecasts of climate change dynamics, climate policy measures and the responses of economic agents have very long horizons and are highly uncertain.

Despite these fundamental obstacles, it is apparent that, in a very dynamic environment, analytical progress is being made and experience is being gained on a broad scale. For example, the use of scenario-oriented climate and climate impact models is continually increasing. The Bundesbank has also started to employ such models when analysing its climate-related financial risks. At the level of individual debtors and exposures, analysts are continuing to work on defining and improving suitable indicators that identify risk drivers and enable conclusions to be drawn about sensitivity and resilience. The term “sensitivity” expresses how affected a debtor is by climate risk drivers, while “resilience” is defined as the ability to adapt to climate-related challenges in a robust manner. An important starting point is to break debtors down into corporate (real economy), bank and sovereign debtors, as very different underlying conditions and analytical concepts exist for these debtor groups.

The Bundesbank will further expand and deepen its risk management in respect of climate risks. The slow but steady improvement likely to be seen in the quality and availability of data and the standardisation of measurement concepts will probably help this process along substantially. Progress in improving the methodological basis will hinge on an intensive exchange of knowledge with other experts who, as in the areas of banking supervision and financial stability, also take a risk perspective – both within the Bundesbank and, in particular, in partnership with other central banks, financial institutions and the world of academia. In areas touching upon the analysis of climate-related risks in monetary policy operations and portfolios as well as risk management options to protect the balance sheet, cooperation with other Eurosystem central banks in the relevant forums is essential.

5. METRICS AND TARGETS

By reporting on climate and sustainability metrics, the Bundesbank is contributing to the Eurosystem's measures to increase transparency regarding potential climate risks and climate compatibility in connection with central banks' own investments.

To this end, the Eurosystem central banks have agreed to further harmonise the selection and methodology of GHG metrics, starting with climate-related disclosures in 2023. The recommendations of the TCFD (Task Force on Climate-related Financial Disclosures) and the PCAF (Partnership for Carbon Accounting Financials) provide guidance in this process.

The methodology of the GHG metrics is described in detail in the annex. In line with this harmonisation within the Eurosystem, the calculation methodology for the carbon footprint GHG metric has been adjusted in this report. In the interests of comparability, the carbon footprint of the euro portfolio published in last year's report (as at 31 December 2021) was therefore recalculated using the adjusted methodology. The adjustment is explained in the relevant section of this chapter.

"Carbon" as a synonym for greenhouse gases (GHG)

In the area of GHG metrics, "carbon" is widely used as a synonym for GHG emissions. The term "carbon" is misleading in the sense that the GHG metrics do not cover carbon dioxide (CO₂) alone but also other greenhouse gases within the meaning of the Kyoto Protocol, including methane (CH₄) and nitrous oxide (N₂O).

The summation of the various greenhouse gases is in accordance with their warming effects; the total is measured in CO₂ equivalents (CO₂e). Based on this measurement principle, CO₂ accounts for around 74% of global GHG emissions, methane for around 17% and nitrogen oxides for approximately 6% (other GHGs: around 2%).³

³ Bundesbank calculation based on data from the World Resources Institute (WRI) on global GHG emissions in 2019.

5.1 Euro portfolio

As at 31 December 2022 (like 31 December 2021), the euro portfolio consisted exclusively of covered bonds. These are bonds issued by banks, which are mainly backed by real estate mortgages. The methodology for the metrics below is based, among other things, on the TCFD recommendations; the metrics refer to the level of bond issuers. The decisive factor is thus the sustainability and environmental performance of banks (in relation to their entire business activities).

5.1.1 GHG metrics

The GHG metrics in this report are the weighted average carbon intensity (WACI), total carbon emissions and the carbon footprint. To calculate these metrics, GHG data derived from the issuing banks' disclosures (such as sustainability reports) are used. They are provided by the ESG data provider ISS ESG. Data on GHG emissions modelled or estimated by data providers are not included in the calculations.

In principle, the aim is to ensure that portfolio holdings and GHG data refer to the same year, should data availability suffice. However, for the reporting dates of both 31 December 2021 and 31 December 2022, the GHG metrics are based on data on banks' GHG emissions in 2021. As this report went to press, these were the most recent GHG data available and were therefore also used for the portfolio reference date of 31 December 2022. For next year's climate-related disclosures, the corresponding calculations are planned to be adjusted retroactively using GHG data for 2022. For the present disclosures, the GHG metrics for the portfolio as at 31 December 2021 have been adapted to GHG data for 2021 (for 2020 in last year's disclosures), following this principle.

| Metrics on the euro portfolio | | | |
|---|-------------|-------------------------------------|--------------------|
| | | Portfolio as at the reporting date: | |
| | | 31 December 2021 | 31 December 2022 |
| Portfolio holdings (by nominal value) | | €10.0 billion | €8.9 billion |
| GHG metrics (coverage in brackets) | | | |
| WACI (tCO ₂ e/million euro of gross income) | Scope 1 & 2 | 1.49 (86.4%) | 1.43 (86.8%) |
| | Scope 1 | 0.51 | 0.53 |
| | Scope 2 | 0.98 | 0.90 |
| Total carbon emissions (tCO ₂ e) | Scope 1 & 2 | 1,445.4 (80.0%) | 1,181.3 (81.6%) |
| | Scope 1 | 622.0 | 552.6 |
| | Scope 2 | 824.5 | 628.8 |
| Carbon footprint (tCO ₂ e/million euro of investment) | Scope 1 & 2 | 0.18 (80.0%) | 0.16 (81.6%) |
| | Scope 1 | 0.08 | 0.08 |
| | Scope 2 | 0.10 | 0.09 |

| Green/brown shares. other metrics (coverage in brackets) | | | |
|---|---------------------------------|------------------|------------------|
| Green share (contributes to environmental goals) | Total | 1.6% (100.0%) | 1.6% (100.0%) |
| | Sustainable energy use | 0.6% | 0.7% |
| | Promoting sustainable buildings | 0.7% | 0.7% |
| | Conserving Water | 0.2% | 0.2% |
| | Other environmental goals | 0.0% | 0.0% |
| Brown share (obstructs environmental goals) | Gesamt | 0.1% (100.0%) | 0.1% (100.0%) |
| | Sustainable energy use | 0.1% | 0.1% |
| | Other environmental goals | 0.0% | 0.0% |
| Carbon risk rating | | 65.6 (100.0%) | 65.9 (100.0%) |
| Sources: ISS ESG. Bundesbank data and calculations | | | |

As at 31 December 2022, the **WACI** of the euro portfolio amounts to 1.43 tonnes of CO₂e per million euro of gross income. This encompasses the issuing banks' scope 1 emissions (0.53 tCO₂e per million euro of gross income) and scope 2 emissions (0.90 tCO₂e per million euro of gross income). The WACI indicates that the euro portfolio is about half as GHG-intensive as the average of the 39 largest European banks by market capitalisation according to the STOXX Europe 600 banks index (2.79 tCO₂e per million euro of gross income, of which scope 1 accounts for 0.90 and scope 2 for 1.88).⁴

Total carbon emissions as at 31 December 2022 amount to 1,181.3 tonnes of CO₂e in the scope 1 and scope 2 categories. Compared with the reference date in the previous year (1,445.4 tCO₂e), this metric points to a significant fall in GHG emissions financed by the euro portfolio. However, this effect is due in part to the reduction in portfolio holdings (from €10.0 billion to €8.9 billion). The carbon footprint, which sets total carbon emissions in relation to portfolio holdings, shows a comparatively smaller decline (from 0.18 to 0.16 tCO₂e per million euro of investment).⁵

However, the aforementioned GHG metrics represent only a small part of the GHG emissions connected with the euro portfolio. This is because neither scope 1 nor scope 2 emissions include GHG emissions associated with the financing activities of the issuing banks. The latter fall under scope 3 emissions, which are not yet adequately accounted for (see Excursus 1). The informative value of the GHG metrics is therefore significantly limited with regard to the euro portfolio.

⁴ Bundesbank calculation based on the composition of the STOXX Europe 600 Banks index as at 1 February 2023 and ESG data from ISS ESG.

⁵ Compared with the Bundesbank's climate-related disclosures for 2022, the method for calculating the carbon footprint has been adjusted to align with the methodological harmonisation among Eurosystem central banks. From now on, the financial size of an enterprise will be measured as the enterprise value including cash (EVIC), which is smaller than total assets, the factor used previously. This change entails an increase in the newly calculated carbon footprint.

Excursus 1:

Scope 3 emissions of banks: data situation and findings regarding the euro portfolio

Scope 3 covers the indirect GHG emissions of a corporation that are generated along the value chain. Scope 3 emissions of enterprises in different sectors can therefore hinge on GHG emissions from various upstream or downstream processes over which corporations do not have the same degree of control. To ensure meaningful comparisons of scope 3 emissions, especially among corporations in different sectors, it is therefore necessary to distinguish between the sources of scope 3 emissions.

The accounting standards of the GHG Protocol incorporate this heterogeneity by differentiating between 15 categories of scope 3 emissions. These facilitate meaningful comparisons of scope 3 subsets. Although banks often already disclose some of their scope 3 emissions, e.g. those attributable to office supplies (category 1), business travel (category 6) or employee commuting (category 7), only a small number of banks record and disclose financed GHG emissions (category 15), which are of major importance in the financial sector. The availability of such data is more limited than that of data on scope 3 categories primarily relating to corporations in the real economy.

Scope 3 data disclosed by banks which include financed GHG emissions are only available for around 13% of the euro portfolio holdings as at 31 December 2022.⁶ Here, scope 3 emissions are almost exclusively attributable to financed GHG emissions (category 15). In these cases, banks disclose scope 3 volumes that are larger than the sum of their scope 1 and 2 emissions by medium three-digit to low four-digit factors. These magnitudes are in line with the results of the 2020 CDP Financial Services Disclosure Report: the Carbon Disclosure Project (CDP), based on data from its corporate surveys, finds that financial institutions report financed GHG emissions that are around 700 times higher than their operational GHG emissions. At the same time, scope 3 disclosures on financed GHG emissions are mostly limited to a few specific asset classes held by financial institutions (e.g. equities, corporate loans or real estate). Consequently, coverage within category 15 also needs to be expanded.

⁶ This is based on data from ISS ESG.

5.1.2 Green and brown shares of business activities

The **green and brown shares** of a portfolio are dependent on the business activities of corporations financed by the portfolio. These metrics are calculated from the shares of corporate revenues stemming from business activities ISS ESG deems to be beneficial (green) or harmful (brown) to the environment in alignment with the UN Sustainable Development Goals (SDGs). If the funded corporations are banks (as in the case of the euro portfolio), shares of business volume (including lending and investment) rather than revenue shares are taken into account. Based on these shares, a weighted average is calculated for the portfolio along similar lines to the WACI methodology.

The **green share** of the euro portfolio is 1.6%, which is above the average green share of STOXX Europe 600 Banks (0.5%).⁷ The green share of the euro portfolio is largely accounted for by bank business activities that are instrumental in achieving the environmental goals of “sustainable energy use” (e.g. financing of renewable energy) and “promoting sustainable buildings” (e.g. financing of buildings certified as energy-efficient).⁸

By contrast, the **brown share** of the euro portfolio stands at 0.1%, which is below the average for STOXX Europe 600 Banks (1.9%). This is due, in particular, to the fact that the business activities of banks whose bonds are held in the euro portfolio have only a comparatively minor focus on financing purchases of vehicles with internal combustion engines.

ISS ESG does not count the majority of financing as either beneficial or harmful to the environment. However, the extent to which environmental impact can be accounted for depends on the level of transparency regarding sustainability – and this varies widely, especially among commercial banks. The metrics thus provide an initial indication of banks’ climate and environmental sustainability, but their informative value could benefit significantly from greater transparency in the financial markets on matters of sustainability.

⁷ Bundesbank calculation based on the composition of the STOXX Europe 600 Banks index as at 1 February 2023 and ESG data from ISS ESG.

⁸ To avoid double counting, the Bundesbank assigns business activities deemed by ISS ESG to contribute to the achievement of several environmental goals to a single goal.

5.1.3 Negative screening for breaches of international standards and involvement in controversial weapons

In accordance with the sustainable investment strategy for the euro portfolio, bond issuers are screened for compliance with minimum standards on an ongoing basis. The negative screening for breaches of international standards is grounded in the norm-based assessment of corporations by the ESG data provider ISS ESG. As at 31 December 2022, the euro portfolio did not include any bonds issued by corporations for which ISS ESG had detected serious proven (e.g. legally) breaches of international standards. Nor did ISS ESG identify any involvement in controversial weapons for any of the corporations. The euro portfolio thus meets the minimum standards set out in the sustainable investment strategy.

5.2 Foreign reserve assets

With regard to the Bundesbank's foreign reserve assets, portfolio holdings are characterised by currency policy-driven requirements. The foreign reserve assets comprise gold holdings, receivables from the IMF and foreign currency reserves.

Gold purchases may also be relevant from a sustainability standpoint. Depending on the origin of the gold, its production may be associated with environmental or climate-related consequences, adverse effects for the local population or harsh working conditions. Looking at existing gold holdings, by contrast, ecological footprints produced by gold production are chiefly relevant from a historical perspective. Accordingly, gold reserves, which are not the subject of the TCFD's recommendations, are not included in the following metrics, which indicate ongoing GHG emissions in connection with financial assets.

The following GHG and sustainability metrics are based on the foreign currency reserves in the foreign reserve assets. They predominantly consist of sovereign and sub-sovereign bonds, of which the majority are US Treasuries. Aside from these, bonds issued by supranationals and agencies (generally national or supranational promotional and development banks) are also held. Assets relating to the Bank for International Settlements (BIS) are not incorporated into the calculation of the metrics.

Foreign currency reserves in the foreign reserve assets

| | Foreign currency reserves at the reporting date: | |
|---------------------------------|--|-----------------------|
| | 31. Dezember 2021 | 31. Dezember 2022 |
| Total (by nominal value) | €32.30 billion | €35.95 billion |
| US dollars | €27.70 billion | €31.41 billion |
| Yen | €1.56 billion | €1.44 billion |
| Australian dollar | €1.12 billion | €1.15 billion |
| Canadian dollar | €1.63 billion | €1.66 billion |
| Chinese yuan (renminbi) | €0.28 billion | €0.28 billion |

5.2.1 Supranational and agency bonds in the foreign reserve assets

The following metrics on supranational and agency bonds are based on the same methodologies applied to the metrics on the euro portfolio (see also 5.1).

| Metrics on foreign reserve assets (supranationals and agencies) | | | |
|--|-----------------------------------|----------------------------------|-------------------------|
| | | Portfolio at the reporting date: | |
| | | 31 December 2021 | 31 December 2022 |
| Portfolio holdings (by nominal value) | | €2.03 billion | €2.16 billion |
| Green/brown shares, other metrics (coverage in brackets) | | | |
| Green share (contributes to environmental goals) | Total | 16.7% (97.8%) | 17.7% (95.4%) |
| | Sustainable energy use | 10.3% | 11.9% |
| | Conserving Water | 4.4% | 4.3% |
| | Preserving terrestrial ecosystems | 0.5% | 0.4% |
| | Preserving marine ecosystems | 0.5% | 0.4% |
| | Promoting sustainable buildings | 0.4% | 0.3% |
| | Other environmental goals | 0.6% | 0.6% |
| Brown share (obstructs environmental goals) | Gesamt | 0.6% (97.8%) | 1.7% (95.4%) |
| | Sustainable energy use | 0.4% | 1.5% |
| | Preserving terrestrial ecosystems | 0.2% | 0.2% |
| | Other environmental goals | 0.0% | 0.0% |
| Sources: ISS ESG, Bundesbank data and calculations | | | |

5.2.1.1 GHG metrics

In comparison to commercial banks, only a few supnationals and agencies have disclosed their operational GHG emissions (scope 1 and 2) to date. It is therefore not possible to calculate GHG metrics that cover a significant proportion of the holdings of supranational and agency bonds. For this reason, the Bank shall not report on these. As is the case for the euro portfolio, the data available on banks' scope 3 emissions are insufficient.

5.2.1.2 Green and brown shares of business activities

Extensive findings are available for the business activities of supnationals and agencies, including their **green and brown shares**. Compared with commercial banks, the mandates of promotional and development banks require greater transparency concerning their financing activities, benefitting the data situation.

As at 31 December 2022, the supranational and agency bonds recorded a sizeable **green share** of 17.7% (previous year: 16.7%). This is predominantly attributable to the financing of efforts to achieve the environmental goal of "sustainable energy use" (e.g. financing of energy efficiency measures, renewable energy and public transport). The funding of projects in favour of the environmental goal of "conserving water" also accounts for a substantial share of business volume (e.g. financing of water treatment facilities).

As with the green share, the brown share also increased, to 1.7% (previous year: 0.6%), but remains at a low level. The majority of the brown share obstructs the environmental goal of "sustainable energy use". The reason behind this is that isolated promotional banks provide financial support for, amongst other things, environmentally harmful sectors such as fossil fuel production and aviation.

5.2.1.3 Negative screening for breaches of international standards and involvement in controversial weapons

In accordance with the sustainable investment strategy for the foreign currency reserves in the foreign reserve assets, supnationals and agencies are screened for compliance with minimum standards on an ongoing basis. The negative screening for breaches of international standards is grounded in norm-based assessment by the ESG data provider ISS ESG. As at the reference date of 31 December 2022, the foreign reserve assets did not include any bonds issued by supnationals and agencies for which ISS ESG had detected serious proven (e.g. legally) breaches of international standards. Nor did ISS ESG identify any involvement in controversial weapons.

5.2.2 Sovereign and sub-sovereign investments in the foreign reserve assets

Sovereign and sub-sovereign investments in the foreign reserve assets predominantly comprise sovereign investments, above all sovereign bonds. Furthermore, they include deposits with the central banks of the relevant sovereigns⁹ and bonds of sub-sovereigns (regions of a country, such as federal states).

For the calculation of most GHG and climate metrics (with the exception of total carbon emissions and carbon footprint), sub-sovereigns are treated as distinct entities (i.e. not identical to their respective sovereigns). In the case of sub-sovereigns, then, the regional GHG emissions and production volumes of fossil fuels are set in relation to the region's GDP by purchasing power parity (PPP).

With regard to previously examined investments (euro portfolio, supranational and agency bonds in the foreign reserve assets), it should be noted that, although the terms and objectives of the GHG metrics overlap somewhat, the calculations are made using asset class-specific methods in the case of sovereign and sub-sovereign investments. The following metrics are therefore only comparable within the sovereign and sub-sovereign asset classes.

⁹ When calculating GHG and climate metrics, deposits with central banks are treated like sovereign bonds and are added to these (i.e. climate data on sovereigns are applied to both).

Metrics on foreign reserve assets (sovereigns and sub-sovereigns)

| | | Portfolio at the reporting date: | | | |
|--|--|----------------------------------|-------------------------|-------------------------|-------------------------|
| | | 31 December 2021 | | 31 December 2022 | |
| Portfolio holdings (by nominal value) | Total | €25.15 billion | | €26.43 billion | |
| | United States | €20.89 billion | | €22.28 billion | |
| | Canada | €1.64 billion | | €1.60 billion | |
| | Japan | €1.56 billion | | €1.44 billion | |
| | Australia | €0.79 billion | | €0.82 billion | |
| | China | €0.26 billion | | €0.28 billion | |
| GHG metrics (100.0% coverage in each case) | | | | | |
| | | Excluding LULUCF | Including LULUCF | Excluding LULUCF | Including LULUCF |
| WACI (in tCO ₂ e/EUR mn GDP adj. by PPP) | Production-based GHG emissions | 333.3 | 296.8 | 333.4 | 296.5 |
| Total carbon emissions (in tCO ₂ e) | Methodology: GDP adj. by PPP as attribution factor | 7.87 million | 7.01 million | 8.28 million | 7.36 million |
| | Methodology: Government debt as attribution factor | 5.55 million | 4.97 million | 5.85 million | 5.23 million |
| Carbon footprint (in tCO ₂ e/EUR mn investment) | Methodology: GDP adj. by PPP as attribution factor | 313.2 | 278.9 | 313.1 | 278.4 |
| | Methodology: Government debt as attribution factor | 220.9 | 197.7 | 205.3 | 183.4 |
| Production volumes of fossil fuels (100.0% coverage in each case) | | | | | |
| Production volume of coal relative to GDP (in TJ/€ mn GDP adj. by PPP) | | 872.9 | | 873.1 | |
| Production volume of crude oil relative to GDP (in TJ/€ mn GDP adj. by PPP) | | 1,753.3 | | 1,739.1 | |
| Production volume of natural gas relative to GDP (in TJ/€ mn GDP adj. by PPP) | | 1,801.1 | | 1,801.1 | |
| Sources: UNFCCC, World Resources Institute, International Energy Agency, World Bank, ECB, Australian Government, Australian Bureau of Statistics, Bundesbank data and Bundesbank calculations. | | | | | |

5.2.2.1 GHG metrics

In principle, when calculating the GHG metrics, the aim is to ensure that portfolio holdings and GHG data refer to the same year, insofar as data availability permits (just as with the previously examined assets). However, sovereign and sub-sovereign GHG data have longer lead times than GHG data on corporations. At the time of reporting, the latest available GHG data refer to 2020.¹⁰ These are used with regard to portfolio holdings as at the reporting dates of 31 December 2021 and 31 December 2022. For subsequent climate-related disclosures, retroactive adjustments to the calculations are planned on the basis of newer data.

GHG emission sector Land use, Land-Use Change and Forestry (LULUCF)

In the case of (sub-)sovereign GHG emissions, two accounting approaches differ with regard to whether or not the emissions sector Land Use, Land-Use Change and Forestry (LULUCF) is included. For example, in regions characterised by forested areas, deforestation may lead to LULUCF being a major or, in some cases, the greatest source of GHG emissions. On the other hand, reforestation may lead to negative emissions, resulting in an improved GHG profile. However, in view of the complicated accounting of LULUCF, climate researchers still have reservations concerning the quality and comparability of such data.

In this report, GHG data are considered both including and excluding LULUCF.

As at 31 December 2022, the **WACI** of the sovereign and sub-sovereign investments in the foreign reserve assets amounts to 333.4 (excluding LULUCF) and 296.5 tCO₂e/€mn GDP adjusted by PPP (including LULUCF). Thus, their GHG intensity is below the global GHG intensity (411.2 tCO₂e/€mn GDP adjusted by PPP excluding LULUCF and 397.6 tCO₂e/€mn GDP by PPP including LULUCF).¹¹

¹⁰ In the case of issuers for which no GHG data are available for 2020, GHG data for 2019 are used.

¹¹ Bundesbank calculations based on global GHG emissions and global GDP adjusted by PPP.

Approaches to the total carbon emissions and carbon footprint of sovereign and sub-sovereign investments

The calculation of the GHG metrics total carbon emissions and carbon footprint has, to date, been less standardised with regard to (sub-)sovereigns than with regard to corporations. Methodological challenges relate to, in particular, the adequate calculation of the shares of GHG emissions attributable to sovereign and sub-sovereign investments. With respect to existing climate-related disclosures of sovereign and sub-sovereign bonds, the volumes of the relevant portfolio holdings have mostly been set in relation to the government debt or the GDP adjusted by PPP in order to measure the share of financed GHG emissions (see II in the annex). However, both approaches have methodological downsides. While (sub-)sovereign bonds depict subsets of government debt, the relationship between the latter and a country or region's GHG emissions is not clear-cut, as the government debt does not represent the sole source of funds for countries or regions. GDP adjusted by PPP is linked to GHG emissions, but not clearly related to sovereign bonds. Despite these reservations, the Bundesbank has included total carbon emissions and carbon footprint based on both approaches in the present disclosures in order to contribute to the discussion of methodological developments and their impact on the GHG balance of portfolios.

As at 31 December 2022, **total carbon emissions** according to the GDP adjusted by PPP as attribution factor methodology amount to 8.28 mn tCO₂e (excluding LULUCF) and 7.36 mn tCO₂e (including LULUCF). When the government debt as attribution factor methodology is used, total carbon emissions are considerably lower, at 5.85 mn tCO₂e (excluding LULUCF) and 5.23 mn tCO₂e (including LULUCF). The reason for this discrepancy is that government debt is higher than GDP adjusted by PPP for the majority of sovereign and sub-sovereign bonds. Both methods show an increase in total carbon emissions compared with the same date a year earlier accordingly. This is chiefly attributable to the growth in portfolio holdings (illustrated by the carbon footprint in the following).

As at 31 December 2022, the **carbon footprint** according to the GDP adjusted by PPP as attribution factor methodology amounts to 313.1 tCO₂e/€mn investment (excluding LULUCF) and 278.4 tCO₂e/€mn investment (including LULUCF). As in the case of total carbon emissions, the government debt as attribution factor methodology produces a significantly smaller carbon footprint: 205.3 tCO₂e/€mn investment (excluding LULUCF) and 183.4 tCO₂e/€mn investment (including LULUCF). Compared with the same date one year earlier, the carbon footprint appears to be stable to slightly declining.¹²

¹² The decrease in carbon footprint when sovereign debt is used as the attribution factor is partly due to the fact that data on sovereign debt are available on a quarterly basis and are more up-to-date than GDP data (which are published annually).

5.2.2.2 Production volumes of fossil fuels

In addition to the listed GHG metrics, examining the production volumes of fossil fuels allows for further insights into the climate performance of sovereign and sub-sovereign investments. Relevant data may serve as an indication of the economic dependency of countries and regions on coal, crude oil and natural gas production. In the wake of the phasing-out of fossil fuels, climate-related financial risks are entailed for sovereigns and corresponding assets. Furthermore, data on production volumes shed light on indirect GHG emissions resulting from exported fossil fuels, which are not covered by conventional GHG data.

Production volumes of coal, crude oil and natural gas are measured by energy content in terajoules (TJ),¹³ and are set in relation to the size of the economy (GDP adjusted by PPP), analogously to the WACI methodology. Weighted averages of the intensity of coal, crude oil and natural gas production volumes are calculated for sovereign and sub-sovereign investments on this basis.

As at 31 December 2022, the **production volume of coal relative to the size of the economy** amounts to 873.1 TJ/€mn GDP adjusted by PPP, and was therefore lower than the global average¹⁴ (1,365.7). By contrast, the **production volume of crude oil relative to the size of the economy** is higher than the global average (1,509.1), at 1,739.1 TJ/€mn GDP adjusted by PPP. The **production volume of natural gas relative to the size of the economy** also exceeds the global average (1,187.2), at 1,801.1 TJ/€mn GDP adjusted by PPP.

5.3 Targets and outlook

In future, the Bundesbank will continue to take account of the consequences of climate change and climate policy in the management of its non-monetary policy financial assets, and in so doing will endeavour in particular to address climate-related financial risks. Alongside this, within the framework of its legal mandate, the Bank could also, in principle, consider climate protection aspects such as potential decarbonisation paths as part of the efforts towards achieving the goals of the Paris Climate Agreement as well as the climate neutrality goals of the Federal Republic of Germany and the EU.

¹³ In accordance with the International Energy Agency (IEA)'s standard for countries' energy balances.

¹⁴ Bundesbank calculations based on global production volumes and global GDP adjusted by PPP.

Such aims must consistently align with the essential objectives of the financial investments. It lies in the nature of the foreign currency reserves portfolio, as part of the foreign reserve assets, that it is concentrated on specific currencies as well as secure and liquid forms of investment. Furthermore, the potential implementation of concrete climate-related targets requires that points of reference for the measurement and management of target achievement exist. As explained in this disclosure, greenhouse gas metrics might be of limited suitability when only referring to scope 1 and 2 emissions if they are of minor significance compared with scope 3 emissions. This is currently the situation of the Bundesbank's euro portfolio. A more suitable approach could be to assess the green and brown shares of the securities issuers' business activities and to aim for a climate-minded development of these shares (see Sections 5.1.2 and 5.2.1).

Over the short to medium term, the Bundesbank aims to, in particular, further advance the quality and coverage of sustainability data. Should, for example, future scope 3 emission data on financial institutions provide better coverage, the disclosed GHG metrics could incorporate scope 1 to 3. The sustainable investment strategies for the euro portfolio and the foreign currency reserves should be advanced and improved against the backdrop of the progress made in these areas. The Bundesbank's annual climate-related disclosures is, in this connection, an important part of the observation and disclosure process.

ANNEX: METHODOLOGY FOR GHG METRICS USED

I. Methodology for GHG metrics relating to corporations

This report uses the methodology of GHG metrics relating to corporations on the euro portfolio and the supranational and agency bonds in the foreign reserve assets.

| Scope 1, scope 2 and scope 3 GHG emissions | | | |
|--|--|---|---|
| | Scope 1 | Scope 2 | Scope 3 |
| Description | A corporation's direct GHG emissions. | A corporation's indirect GHG emissions from the generation of energy (electricity, heat) purchased from energy producers. | A corporation's indirect GHG emissions that are not included in scope 2. Encompasses all other upstream and downstream processes along the corporation's value chain. |
| Unit of measurement | Tonnes of CO ₂ equivalents (tCO ₂ e) | | |
| Source | Corporations' disclosures (e.g. sustainability reports) | | |
| Included in GHG metrics | Yes | Yes | No, as current coverage is insufficient. |

Corporations: Weighted average carbon intensity (WACI)

| | |
|-------------|---|
| Formula | $\sum_n^i \left(\frac{\text{Value of investment}_i}{\text{Portfolio value}} \times \frac{\text{GHG emissions of corporation}_i}{\text{Revenue of corporation}_i} \right)$ |
| Description | <p>First, the GHG intensities of the individual corporations are calculated by setting a corporation's GHG emissions in relation to their revenue (or, in the case of financial institutions, their gross income). Next, the corporations' GHG intensities are multiplied by the shares of the portfolio that the investments in the respective corporations represent.</p> <p>This gives the weighted average carbon intensity (WACI) for the entire portfolio. The result provides an indication of whether a portfolio invests in more GHG-intensive corporations in comparison with other portfolios or with a benchmark.</p> |

Corporations: Total carbon emissions

| | |
|-------------|--|
| Formula | $\sum_n^i \left(\frac{\text{Value of investment}_i}{\text{EVIC of corporation}_i} \times \text{GHG emissions of corporation}_i \right)$ |
| Description | <p>Total carbon emissions refer to the amount of GHG that is financed by a portfolio. This amount is therefore heavily dependent on the size of the portfolio (and is accordingly counterbalanced by the carbon footprint metric).</p> <p>The calculation is based on the share of the enterprise value including cash (EVIC) that is financed by a portfolio. The same share of the corporation's GHG emissions is attributed to the portfolio.</p> |

Corporations: Carbon footprint

| | |
|-------------|---|
| Formula | $\frac{\sum_n^i \left(\frac{\text{Value of investment}_i}{\text{EVIC of corporation}_i} \times \text{GHG emissions of corporation}_i \right)}{\text{Portfolio value}}$ |
| Description | The carbon footprint sets the total carbon emissions of a portfolio in relation to the size of the portfolio (e.g. financed GHG emissions per €mn of investment). |

II. Methodology for GHG metrics relating to sovereigns and sub-sovereigns

This report uses the following methodology for GHG metrics on sovereign and sub-sovereign-related assets in the foreign reserve assets.

| Sovereigns and sub-sovereigns: GHG emissions | | | |
|--|--|--|---|
| | Production-based/ territorial | Consumption-based | Public/government sector |
| Description | Sovereigns and sub-sovereigns are assigned those GHG emissions which occur within the borders of that country or region. | Incorporates foreign trade data. Sovereigns and sub-sovereigns are assigned those GHG emissions which occur during the production of goods consumed in that country or region. | Only GHG emissions that occur in the public sector are assigned to sovereigns. |
| Unit of measurement | Tonnes of CO ₂ equivalents (tCO ₂ e) | | |
| Sources | UNFCCC, World Resources Institute, national (statistics) offices | – | – |
| Included in GHG metrics | Yes | No. Thus far, available data do not cover all greenhouse gases and relevant sub-sovereigns. | No. Thus far, data do not cover all relevant sub-sovereigns. Methodology also less established, esp. compared with production-based approach. |
| Additional remarks | Differentiation between whether the emission factor LULUCF (Land Use, Land-Use Change and Forestry) is included or not. | – | – |

Sovereigns and sub-sovereigns: Weighted average carbon intensity (WACI)

| | |
|-------------|--|
| Formula | $\sum_n^i \left(\frac{\text{Value of investment}_i}{\text{Portfolio value}} \times \frac{\text{GHG emissions of (sub-)sovereign}_i}{\text{GDP by PPP}_i} \right)$ |
| Description | <p>To calculate the GHG intensities of sovereigns und sub-sovereigns, GHG emissions are set in relation to GDP by purchasing power parity (PPP). The GHG intensities are multiplied by the shares of the portfolio that the investments in the respective sovereigns and sub-sovereigns represent.</p> <p>This gives the weighted average carbon intensity (WACI) for the entire portfolio. The result provides an indication of whether a portfolio invests in more GHG-intensive corporations in comparison with other portfolios or with a benchmark.</p> |

Sovereigns and sub-sovereigns: Total carbon emissions

| | |
|-------------|--|
| Formula | $\sum_n^i \left(\frac{\text{Value of investment}_i}{\text{GDP by PPP}_i} \times \text{GHG emissions of (sub-)sovereign}_i \right)$ <p style="text-align: center;">or</p> $\sum_n^i \left(\frac{\text{Value of investment}_i}{\text{Government debt}_i} \times \text{GHG emissions of (sub-)sovereign}_i \right)$ |
| Description | <p>Total carbon emissions refer to the amount of GHG that is financed by a portfolio. This amount is therefore heavily dependent on the size of the portfolio (and is accordingly counterbalanced by the carbon footprint metric).</p> <p>The calculation is based on the share of a (sub-) sovereign that is financed by a portfolio. To determine this, the value of an investment is set in relation to the GDP adjusted by PPP or to the government debt (general government debt, i.e. including sovereign and sub-sovereign debt). The same share of the (sub-)sovereign's GHG emissions is attributed to the portfolio.</p> |

Sovereigns and sub-sovereigns: Carbon footprint

| | |
|--|---|
| Formula | $\frac{\sum_n^i \left(\frac{\text{Value of investment}_i}{\text{GDP by PPP}_i} \times \text{GHG emissions of (sub-)sovereign}_i \right)}{\text{Portfolio value}}$ <p style="text-align: center;">or</p> $\frac{\sum_n^i \left(\frac{\text{Value of the investment}_i}{\text{Government debt}_i} \times \text{GHG emissions of (sub-)sovereign}_i \right)}{\text{Portfolio value}}$ |
| Description | The carbon footprint sets the total carbon emissions of a portfolio in relation to the size of the portfolio (e.g. financed GHG emissions per €mn of investment). |
| Comparison to WACI (sovereign) formula | The formula with GDP adjusted by PPP is equal to the formula for the WACI (sovereigns and sub-sovereigns). In this disclosure, however, differences can be seen in the results. These are primarily attributable to differing reference years for GDP. For the WACI, GDP refers to the year in which the GHG emissions occurred. In the case of the carbon footprint, however, GDP refers to the year of the portfolio holdings. When calculating the carbon footprint, sub-sovereigns are not considered as distinct entities, but are assigned to the relevant sovereign, in contrast to in the WACI calculation. |