THE MAGYAR NEMZETI BANK'S CLIMATE-RELATED FINANCIAL DISCLOSURE

2024

APRIL

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Published by the Magyar Nemzeti Bank

Publisher in charge: Eszter Hergár

H-1013 Budapest, Krisztina körút 55.

www.mnb.hu

ISSN 2939-5100 (print)

ISSN 2939-5119 (on-line)

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Executive Summary

The Magyar Nemzeti Bank views climate change as a source of systemic risk. *Climate change effects may have far-reaching consequences and the potential to negatively impact the MNB's ability to fulfil its statutory primary and secondary objectives.*

The MNB's statutory objectives include, both directly and indirectly, promoting environmental sustainability and addressing the risks caused by climate change. *Even the primary mandate of the central bank provides an opportunity to take action against climate change. Since the middle of 2021 the "green mandate" has further strengthened this, since it has become an explicit goal to support - without jeopardizing the primary goal of price stability - environmental sustainability. Accordingly, the MNB's decision-making bodies are regularly informed about the impact exerted by climate change and other environmental risks on the financial system and the MNB's operations.*

The MNB's strategy on environmental sustainability has been developed in line with its mandates and organisational structure as set out in the law. *In the Green Monetary Policy Toolkit Strategy, the MNB has set out a framework for the implementation of environmental sustainability considerations in the use of monetary policy instruments. The Charter of Sustainable and Responsible Investment, published in 2023, expresses the central bank's commitment to integrating climate risks into reserve management and sets out medium- and long-term targets. The Green Programme defines the MNB's supervisory strategy in support of the stability of the financial intermediary system. The MNB operates an environmental management system to green its own operations; strategic planning consists of 3-year cycles. The target for the period 2023-2025 is to achieve a 75 per cent reduction in direct CO_2 emissions.*

The TCFD report assesses climate risk exposures related to the MNB's balance sheet and its own operations. *Climate change has an indirect impact on the work of the financial supervisory authority, an analysis of which is presented in the Green Finance Report.*

The MNB analysed the climate-related risk exposure of its financial assets according to the two main risk categories (transition and physical risks) broken down by portfolios. *The MNB analyses the risks using metrics commonly applied in international practice, supplemented by its own estimates and special analyses in certain asset categories.*

In 2023, the carbon intensity of sovereign exposures in the foreign exchange reserves decreased due to changes in the structure of the portfolio. *However, the combined emissions trajectories of the countries in the portfolio remain still misaligned with the targets set out in the Paris Climate Accords. Despite this, the portfolio is largely protected against climate risks, mainly due to the relatively short duration and the considerable adaptive capacity of the countries. For the countries of the sovereign exposures in the reserves, sea level rise and floods are the main physical risk factors.*

In 2023, the analytical framework was extended to also cover the corporate exposures in the reserve. *The portfolio's exposure to transition risks is relatively moderate; the negative screening indicators suggest no material risks.*

The MNB analyses a wide range of transition risks in the monetary policy portfolios, *no new exposures are created in the programmes for the time being; the existing portfolio is gradually amortizing through repayments.*

In 2023, the climate impact of the dedicated green bond portfolio within the foreign exchange reserves was significant: the 66 thousand tonnes of GHG emissions avoided per year are roughly equivalent to the annual carbon footprint of a Hungarian municipality of 13 thousand inhabitants. *At the end of 2023 the MNB decided to double the size of the portfolio to EUR 500 million. In addition to the foreign exchange reserves, the MNB also supports GHG emission reduction through its Green Home Programme and Green Mortgage Bond Purchase Programme.*

The MNB has exceeded its previous target, with its carbon footprint per employee decreasing by almost 60 per cent by the end of 2022 compared to the baseline. *Based on preliminary data, a further reduction of around 5 percentage points is expected in 2023, mainly due to energy saving measures. To compensate for emissions that cannot be reduced any further, the MNB has financed habitat restoration projects.*

Introduction

In 2015, the G20 Financial Stability Board (FSB) established the Task Force on Climate-related Financial Disclosures (TCFD) to provide recommendations on climate-related disclosure reports. This facilitates more informed investment, lending and insurance decisions and allows market participants to better understand the concentration of GHG-intensive assets in the financial sector and the exposure of the financial system to climate-related and environmental risks. In a more transparent and stable market, these risks are more effectively incorporated into strategic decision-making, thereby supporting capital flows towards sustainable investments.

In addition to the TCFD recommendations, binding regulations coming into force gradually will also improve environmental transparency and comparability. In recent years, the European Union has sought to promote transparency on the European financial markets through a number of regulations such as the Sustainable Finance Disclosure Regulation (SFDR) and the Corporate Sustainability Reporting Directive (CSRD).[1] In an important step forward, the European Commission published its Sustainable Finance Package in June 2023, expanding the range of economic activities and industries that can be compliant with the sustainability criteria of the EU Taxonomy, and proposing a common set of rules for ESG certification bodies.

The European Sustainability Reporting Standards (ESRS), required under the CSRD to harmonize sustainability reporting, were published in December 2023[2]. The large corporates concerned will have to apply the general ESRS's from 2025 in their reporting for the year 2024, while the application of the sector-specific ESRS's has been postponed until 2026, as agreed by the European Parliament and the Council, in order to reduce the administrative burden on companies.

Another significant development for bond markets is the European Green Bond Standard (EU GBS) entered into force in December 2023, which sets out the conditions for issuing European Green Bonds. Overall, the requirements outlined above may further improve the quantity and quality of the sustainability data available.

Although the mandatory disclosure requirements are not applicable to it, the MNB aims at setting an example by publishing its climate-related financial disclosure report in line with the TCFD recommendations.

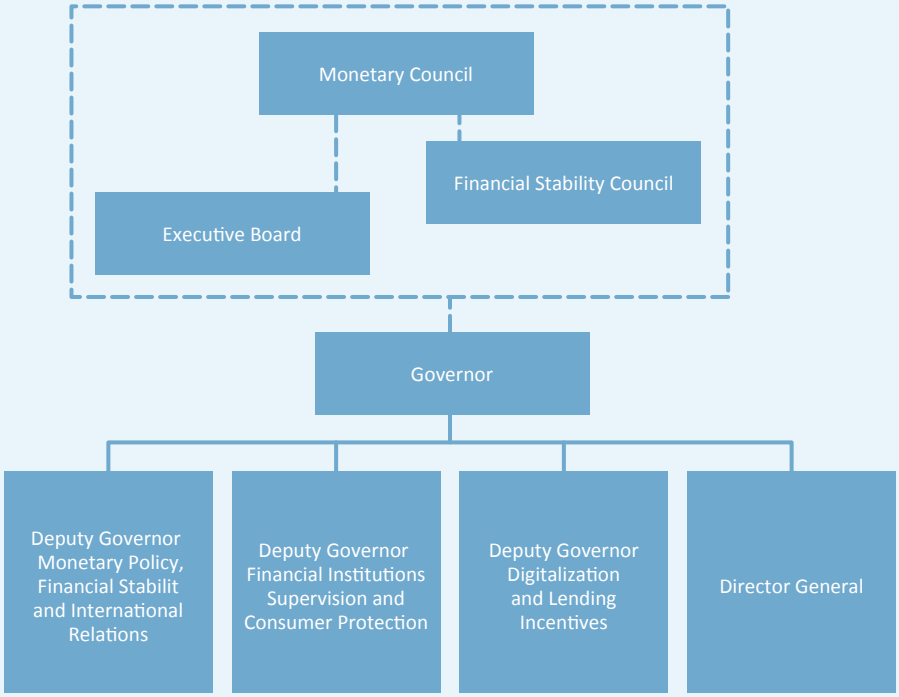
[1] The regulation was transposed into Hungarian law by the amendment of Act C of 2000 on Accounting; the new provisions will apply from 1 January 2024.

[2] Commission welcomes agreement on postponing adoption deadlines for certain European Sustainability Reporting Standards

1 Corporate governance

The MNB's decision-making bodies are the Monetary Council (MC), the Financial Stability Council (FSC) and the Executive Board (EB). The senior management of the MNB are the Governor, the Deputy Governors and the Director General. Decision-making bodies and senior MNB executives are regularly informed of the impact of climate change and other environmental risks on the financial system and the MNB's own operations.

Chart 1
Organizational structure of the MNB



The main decision-making body of the MNB is the Monetary Council. The powers of the MC include, inter alia, strategic decisions relating to monetary policy, the issuance of legal tender, the accumulation and management of foreign exchange and gold reserves, the conduct of foreign exchange operations in the context of the implementation of exchange rate policy, as well as strategic decisions on statistical tasks. The MC is also empowered to decide on the strategic framework related to macroprudential tasks, the oversight of payment and settlement and securities settlement systems, the oversight of the financial intermediary system and the functioning as resolution authority. The members of the MC are the Governor, the Deputy Governors and members elected by the National Assembly. The MC monitors the impact of climate change and other ecological risks on the financial system on a regular basis and supports adaptation to environmental risks through its strategic decisions.

Within the strategic framework defined by the MC, the Financial Stability Council (FSC) acts on behalf of the MNB in decision-making related to the oversight of payments and settlement and securities settlement systems, macroprudential and resolution authority tasks, and the supervision of the financial system. The members of the FSC are the Governor and Deputy Governors of the MNB, executives appointed by the Governor of the MNB, and the Director General. The FSC regularly monitors the impact of climate change and other ecological risks on the financial system and financial stability

and takes measures to support the financial system's adaptation to climate change and Hungary's transition to a climate-friendly and ecologically sustainable economy.

As the MNB's executive body, the EB is responsible for implementing the decisions of the MC and the FSC, and for managing the MNB's operations. The members of the EB are the Governor and the Deputy Governors of the MNB. The EB is regularly informed about the impact of climate change and environmental risks on the financial system and the MNB's operations, while through its actions it contributes to the implementation of the decisions of the MC and the FSC in support of environmental sustainability. The EB, responsible for managing the MNB's operations, is empowered to decide on the identification, management and measurement of major environmental risks and on the implementation of its investments in support of environmental sustainability.

The Governor is the top executive of the organization. The departments under the Governor's direct management are responsible for the MNB's academic and other educational activities related to sustainable finance.

The departments under direction of the Deputy Governor responsible for monetary policy, financial stability and international relations are responsible for formulating the central bank's proposals for structural reforms to ensure sustainable development in Hungary; conducting research on sustainable economic growth; monitoring Hungarian and international macroeconomic topics and economic policies that support sustainable growth; and assessing the function of the financial system to support sustainable economic growth. The departments are responsible for exploring, identifying and implementing opportunities for the development of the domestic green credit and bond market by the central bank; for creating the green toolkit strategy, and for supporting and coordinating the MNB's sustainability-related international tasks.

The departments under the direction of the Deputy Governor responsible for financial supervision and consumer protection are responsible for conducting analyses and research on financial services and products that support environmental and social sustainability; identifying the prudential implications and risks of climate change and other ecological anomalies and conducting supervision activities related to these and to sustainable financial regulation; developing the MNB's position and proposals on sustainable finance; and contributing to the MNB's educational, training, awareness-raising, research and international relations-related tasks in the field of sustainable finance. The activities of the Deputy Governor regarding sustainability have been supported by a dedicated unit, the Sustainable Finance Department.

The organizational units reporting to the Deputy Governor responsible for digitalization and lending incentives are responsible for exploring and implementing opportunities for the development of the domestic green credit market.

The departments under the Director General's direction are responsible for reducing the MNB's carbon footprint from its own operations; the greening of cash logistics processes; operating the MNB's Environmental Management and verification System; monitoring the MNB's waste management activities; developing and implementing the MNB's Corporate Social Responsibility Strategy; and disseminating an environmentally sustainable financial culture and awareness in the broad layers of society.

In addition to ad-hoc cooperation and multi-disciplinary projects, the areas of expertise dealing with sustainability and environmental risk topics also report on their activities to each other at regular **Green Workshop** meetings at the middle management and expert level; this forum is responsible for coordinating climate risk tasks and projects within the MNB.

2 Strategies

The core duties and the operational framework of the MNB are set out in the MNB Act. The MNB's primary objective is to achieve and maintain price stability. Without compromising its primary objective, the MNB also supports the maintenance of stability and improvement of the resilience of the financial system, its sustainable contribution to economic growth and to support the economic policies of the government using the instruments at its disposal.

The amendment to the legislation, which entered into force on 2 August 2021, extended the MNB's mandate to support government policy on environmental sustainability. With the amendment, the MNB is legally obliged to integrate environmental sustainability considerations in its activities without compromising its primary objective.

2.1 GREEN MONETARY POLICY TOOLKIT STRATEGY

The MNB identifies a number of risks stemming from climate change that could have an impact on price stability and financial stability. Accordingly, environmental sustainability considerations must be taken into account in the design of the toolkit in the context of the feasibility of the primary mandate. In July 2021, the document '*Sustainability and central bank policy – Green aspects in the MNB's monetary policy toolkit*'[3] was published, which sets out the strategic orientations for mainstreaming long-term environmental sustainability considerations through central bank instruments. In line with this, the MNB introduced the following measures:

- **Green Mortgage Bond Purchase Programme (GMBPP):** this was the MNB's first asset purchase programme with a sustainability focus, aiming to create a green mortgage bond market in Hungary, thereby creating green housing lending and expanding the energy-efficient housing stock. In line with the tightening of the monetary policy stance, in 2022 the MNB suspended purchases under the programme.

- **Green Home Programme (GHP):** launched as part of the Funding for Growth Scheme, the programme promoted the creation of a green housing loan market and the mainstreaming of environmental sustainability considerations in the domestic housing market by providing low-interest financing from the central bank. With an overall allocation of HUF 300 billion, the programme enabled around 8,600 households to build or buy an energy-efficient[4] new home. The program was closed at the end of September 2022.

- **Green collateral management:** In its monetary policy-related collateral management activities, the MNB assumes risks via the assets it accepts as collateral. For this reason, the Bank explored opportunities for green collateral management, which can have an impact on greening bank exposures through liquidity management at commercial banks and can support the growth of the market of green bonds. The MNB supports the issuance of green securities by applying preferential haircuts, and it promotes standardization and transparency through green reporting requirements.

- **Fitting macroprudential measures into the green monetary policy toolkit:** Since July 2021 the rules on the Mortgage Funding Adequacy Ratio (MFAR) regulation have given preferential treatment to stable mortgage funding for energy-efficient properties. The measure supports the development of banking frameworks for the uptake of green capital market instruments, the increase in the share of mortgage loans that finance energy-efficient real estate and the diversification of the range of mortgage bond investors in support of financial stability.

[3] *Sustainability and central bank policy – Green aspects in the MNB's monetary policy toolkit*

[4] The terms and conditions require that the property must have an energy rating of at least BB and a maximum total energy demand of 90 (subsequently 80) kWh/m2/year.

2.2 GREEN FOREIGN EXCHANGE RESERVES STRATEGY

One of the MNB's basic statutory tasks is the management of the country's foreign exchange reserves. The purpose of maintaining foreign exchange reserves is to support monetary and exchange rate policy; to provide the necessary foreign currency liquidity; to maintain investor confidence, and to secure the transactional foreign currency needs of the State. When investing the foreign exchange reserves, the central bank follows a tripartite objective system of safety-liquidity-return, i.e., it aims to achieve the highest possible level of returns while keeping risks low and providing the necessary liquidity. In line with conservative portfolio management, the exposures of the foreign exchange reserves are well-diversified, a significant proportion of the foreign exchange reserves are made up of highly rated government securities, considered to be free of credit risk, and they also contain highly rated supranational, corporate and banking issuances.

In addition to meeting the primary objectives of reserve maintenance, central banks may have an important role to play in the successful implementation of the green transition of economies, e.g., by supporting the green bond markets ('supportive approach'). In addition, the value of foreign exchange reserves may be strongly affected by the realization of the climate risks associated with financed issuances ('defensive approach'). Although the likelihood of risks materializing only appears to be significant in the longer term, even in the short term it is still unavoidable to explore the issue and assess the investment strategy from a climate risk perspective.

As a first step, the MNB decided in 2019 to construct a dedicated portfolio of green bonds within its foreign exchange reserves. The portfolio consists of 'green-labelled' bonds (green bonds) that comply with international green standards and the general rules on reserve management, where the funds raised are used by the issuer for a specific, environmentally beneficial, 'green' investment. In 2023, the MNB decided to double the portfolio target to EUR 500 million, as measured at fair market value.

In order to further integrate sustainability considerations into foreign exchange reserves management, the MNB published its *Charter of Sustainable and Responsible Investment*[5] at the end of 2023, setting out objectives in the medium and the long term. Besides providing guidance on how to integrate green considerations in the foreign exchange reserves investment strategy, the document can serve as a model for financial market participants to follow.

2.3 GREEN SUPERVISORY STRATEGY

Environmental risk management is highlighted in the supervisory strategy. As a financial supervisory authority, the MNB is committed to strengthening, preserving and improving the stability of the financial system, with a particular focus on consumer protection, digitalization and sustainability. The supervisory objectives of the MNB are summarized in the document '*Stability and Confidence 2.1*'[6].

In January 2019, the MNB launched its Green Programme[7], which consisted of several measures concerning the financial system, including analyses to explore environmental risks and improve the resilience of the financial system and develop the environment for green financing, as well as building relationships across society and internationally (education, research, building domestic and international professional relationships).

As banks play a key role in the carbon-neutral transition of the entire Hungarian economy, it is a basic expectation that they are able to make informed strategic and business decisions in this regard. In 2022, the MNB published a Green Recommendation[8] to encourage credit institutions to switch to green operations by 2025, i.e., identify, measure, manage, monitor and disclose climate and environmental risks.

[5] The MNB's Charter of Sustainable and Responsible Investment
[6] The MNB's supervisory and consumer protection strategy
[7] Green Programme of the MNB
[8] The MNB's Green Recommendation and Green Insurance Recommendation

Participants of the insurance market are exposed to environmental risks in a variety of ways, from drought insurance to liability claims and the revaluation of investments, thus the green transition is important for them as well. As a first step, the MNB conducted a survey in 2022 on preparedness for climate change in the insurance sector, then published its Green Insurance Recommendation in late 2023. The requirements in the Recommendation will come into force on 1 January 2025; 2024 will be a year for preparations.

In order to support innovation of sustainable financial products, the MNB launched an online Green Financial Product Finder in spring 2023. With the creation of the portal at *zoldpenzugyitermek.mnb.hu*, the MNB aims to promote the dissemination of sustainability and financial information about the green investment products available to the general public and facilitate the comparison of green financial products.

Given the central role of the financial system in capital allocation, it is important to mobilize financial services towards financing sustainable economic activities. The MNB has therefore launched a preferential capital requirement programme for banks in the retail, corporate and municipal lending segments, the latter including green bonds too.

In one of the most uncharted yet increasingly important segments of green finance (the so-called voluntary carbon market), the report "*Nature-based Carbon Neutralization 2023: a Roadmap for Companies*"[9] provides guidance for Hungarian companies setting environmental sustainability targets.

2.4 SUSTAINABILITY STRATEGY FOR THE MNB'S OWN OPERATIONS

In order to reduce the environmental footprint of MNB's operations, the Bank operates an Environmental Management System (EMS). The system was introduced in 2011 after an assessment of the major environmental risks. Accordingly, the two main objectives of the Bank's long-term environmental strategy are: (i) reducing the environmental footprint of the buildings used in its operations and (ii) reducing the carbon footprint of the cash supply chain.

- **In recent years, the MNB has sought to rely increasingly on renewable sources in its energy usage**. Today, all its electricity purchases come from renewable sources. The MNB aims to further reduce its carbon footprint from its operational activities, even if it cannot be eliminated completely. To compensate for emissions that cannot be reduced any further, it finances habitat restoration projects that can absorb all remaining emissions in the years ahead.

- **Reducing the carbon footprint of the cash supply chain is one of the key priorities within the MNB's long-term environmental strategy.** Ensuring the smooth circulation of cash is one of the MNB's core tasks. It is important for the MNB to guarantee fair access to cash in the long term as well, therefore only solutions that do not jeopardize the continued reliable supply of cash to households, businesses and credit institutions may be considered when reducing the carbon footprint of the supply chain. (It is important to note that cash remains the most commonly used means of payment in Hungary, despite the continuous development of electronic payment solutions.)

The environmental burden of the cash supply chain has three main components: i) cash production, the activities of the subsidiaries involved in the manufacture of cash; ii) cash logistics activities within the MNB (distribution, processing); iii) the activities of cash logistics service providers (suppliers).

An important consideration when setting environmental requirements for the MNB's partners is that the MNB has no legal instruments at its disposal to demand that credit institutions, post offices and cash processors operate in an environmentally responsible manner. Nevertheless, the MNB orients the actors towards environmentally conscious operation in a consultative manner, in the form of "soft" recommendations.

[9] Nature-based Carbon Neutralization 2023: a Roadmap for Companies

The MNB's environmental management system operates on 3-year cycles; the current cycle covers the period 2023-2025 and has the following strategic objectives:

- **Maintaining carbon neutral operations:**

– The MNB will continue to reduce the carbon footprint of its operations as far as possible, aiming to shrink its per-capita carbon footprint by 75 per cent by the end of 2025 compared to the 2019 baseline (i.e., by a further 15 percentage points compared to the end of 2022).

– All the electricity used in the office buildings serving the MNB's operations continues to come from renewable sources.

– It continues to offset any carbon emissions from its operations that are impossible to be reduced any further.

- **Further improving the environmental performance of the buildings used by the MNB in its day-to-day operations:**

– The MNB will pre-certify its Buda Centre building according to the BREEAM In-Use standard and use the pre-certification results to identify any areas for improvement.

– The MNB will ensure that the Logistics Centre building will keep its Excellent performance rating.

- **Exploring the possibility of introducing new environmentally friendly technologies as a way of improving internal operating processes:**

– It will conduct a technology test to introduce chemical-free office cleaning and workplace composting practices and, depending on the results, propose their introduction.

- **Further reducing the carbon footprint of the cash supply chain:**

– In order to promote the increased recycling of local banknotes and coins by the credit institutions as well as the reduction of the transportation tasks of cash processing entities in the supply chain and the reduction of packaging materials, the central bank will play a consultative role and guide stakeholders towards environmentally conscious operations. In 2023, the MNB issued a recommendation on the enforcement of environmental sustainability considerations[10].

– In 2023, the Hungarian Mint Ltd. Obtained ISO 14001 environmental certification. This means that all subsidiaries[11] involved in cash production operate to high environmental standards.

2.5 NATIONAL AND INTERNATIONAL COOPERATION

In order to implement its green programmes effectively and to exchange best practices, the MNB builds professional relationships at national and international level. The Bank intends to work in partnership with domestic government, market and social actors with knowledge and capacity relevant to climate change and green finance, taking advantage of synergies arising from the cooperation.

In addition to domestic actors, the MNB is also seeking to build international relationships in the field of climate risk and green finance initiatives. Since 2019 the MNB has been an active member of the Network for Greening the Financial System (NGFS), a global central bank and supervisory initiative. The MNB has also joined the Advisory Council of the Energy Efficient Mortgages Initiative (EEMI), which aims to promote preferential loans for energy efficiency investments. The MNB is also actively involved in the development of related regulations by the European Supervisory Authorities[12].

[10] The MNB's green recommendation for cash processors
[11] DIPA Diósgyőri Papírgyár Zrt., Hungarian Banknote Printing Company., Hungarian Mint Ltd.
[12] EBA, ESMA, EIOPA

The MNB takes an active role in promoting sustainability awareness. Through its social contacts, the MNB intends to support awareness-raising and educational activities on green finance. To increase the knowledge base on green finance, green finance courses, advanced college events and adult education courses are offered in cooperation with universities in Hungary.

Starting from 2019, the MNB hosts an annual international green finance conference in Budapest, with the participation of renowned international experts, market participants and policymakers. These occasions are also used to reward academics and research teams for their excellence in environmental issues and green finance. Specialist articles and studies on sustainability by MNB experts also help to raise awareness.

3 Risk management

3.1 THE CHARACTERISTICS OF CLIMATE RISKS

When analysing climate change risks, it is important to apply the principle of "double materiality", which means that while the consequences of climate change may affect an institution financially, the same institution may also exercise an impact on the environment itself, through its activities and investments. In its analysis of climate risks, the MNB considers both the transition and the physical risk channels.

- **Transition risks arise from the difficulties of transitioning to a low-carbon and climate-resilient economy.** Changes in policy or technology, or rapid shifts in consumer attitudes, can all cause a sudden revaluation in the price of financial instruments. As a consequence, credit and market risks may increase and, in certain scenarios, the resulting losses could carry financial stability risks as well.

- **Physical risks arise from the physical effects of climate change, i.e., changes in the long-term climate and an increase in the severity and frequency of extreme weather events.** With physical risks, it is not only the risk of losses due to the destruction of physical assets and infrastructure that is considered, but also the breakdown of value chains, loss of biodiversity, negative impacts on human health and well-being, which in extreme cases could lead to migration and conflict. This may have an impact on the productivity of certain companies or the value of physical and financial assets, which may also affect financial stability.

Given the specific characteristics of climate risks, traditional risk management frameworks must be adapted to account for them as well. Climate change leads to changes that are characterized by a high degree of uncertainty, i.e., determined not only by the interaction of economic and financial impacts, but also inter alia by environmental, technological and cultural impacts. These processes interact with each other to generate unpredictable impacts that are wide-ranging and potentially very severe. These risks are non-linear, irreversible and characterized by a fat tail distribution.

Many of the impacts of climate change will materialize and be reflected in financial risks over longer time horizons, but that they can only be mitigated by actions taken today. Long horizons are difficult to align with traditional business planning and risk taking. In addition, the lack of necessary data is also a major problem. High quality, abundant data are essential to understand and assess risks accurately and to develop reliable models. Since models based on historical data are not always sufficient, forward-looking estimates are also required, for example through scenario analysis or climate stress tests.

Unlike traditional financial (e.g., market, liquidity and lending) risks, climate risks have the special characteristics that, although the details of how climate-related and environmental risks will materialize are unknown, it can be stated with absolute certainty that the materialization – of some combination – of the transition and physical risks is inevitable. Their timing, severity and subsequent manageability will depend on how we respond to them: if the targets of the Paris Agreement are met globally, we will face higher transition risks, but otherwise the future will be determined by the occurrence of physical risks.

The process of risk management can be divided into distinct, successive phases. The first step is to identify the risks that threaten the institution's operations and business. Risk assessment involves determining their materiality and magnitude. The active management of risks comes after these steps. From the perspective of the MNB, there are some risks that it only monitors, while it purposefully seeks to mitigate others. Each central bank function has different risk characteristics, taking into account their objectives, and thus the risks are presented in a breakdown by central bank functions.

3.2 MONETARY POLICY

Through its monetary policy tools and reserve management, the MNB takes Hungarian and foreign, typically bond or loan-type exposures onto its own balance sheet. The MNB monitors and analyses the risks from these exposures and takes into account not only monetary policy but also risk management considerations in its relevant decisions. At the MNB, the tasks of identifying, measuring and managing risks to the central bank's balance sheet, preparing decisions and monitoring risks are performed by a single unit. The management of climate risks should also be integrated into this conventional framework.

3.2.1 Central bank asset purchases

In its asset purchase programmes the MNB acquired mainly government securities, mortgage bonds and corporate bonds. During the period of monetary easing, the primary objectives of these instruments included ensuring the achievement of the inflation target and supporting companies' access to long-term, low-cost funding and developing certain markets. The introduction of these instruments has increased the MNB's balance sheet and risk exposure. Before launching the programmes, the MNB assessed the key parameters (e.g., amount, maturity) and their impact and risks (credit risk, market risk) on its balance sheet. Between December 2021 and May 2022, the MNB gradually suspended or discontinued its asset purchase programmes in line with the tightening of the monetary policy orientation and the utilization of the allocations.

It is also true for asset purchase programmes that taking climate risk considerations into account allows the MNB to support the green transition of the economy and the government's economic policy and environmental sustainability objectives more effectively. The green transition of the Hungarian economy could also improve the MNB's bond exposures from a climate risk perspective.

3.2.2 Central bank loans/collateral management

The lending activities of central banks serve a range of purposes. Traditional central bank lending is a short-term (e.g., overnight, one-week) commitment, which plays a key role in the liquidity management of the banking sector as and when necessary. In recent years, however, central banks have also used longer-term targeted lending programmes. In accordance with the MNB Act, the Bank does not assume credit risk in its lending activities, i.e., it originates credit to money market clients only in secured form.

The MNB also evaluates the climate-related risks in the context of lending and collateral management. By shaping these programmes in a targeted way, central banks can encourage the green transition in the economy and green lending in the banking sector. They can influence market participants through the collateral management framework, via their exposure to bank funding and liquidity management, for example by giving preferential treatment to certain asset classes in order to influence the spreads of issuances.

In addition to the aforementioned policy considerations, the MNB also takes into account the financial risks of climate exposures associated with collateral. By modifying the framework, climate risk exposures can also be reduced for the securities accepted in collateral management. (It should be noted, however, that the exposure of a central bank during collateral management is only indirect, as the primary obligor of lending activity is the lending bank, and collateral is included in the central bank balance sheet only in the event of a bank default.) Overall, a greener collateral pool may be preferable for the central bank due to potentially lower default risk or higher returns and lower price volatility.

3.2.3 Foreign exchange reserves

The MNB determines its investment policy in the course of its reserve management, taking into account the central banking objectives, by considering the triple criteria of risk, liquidity and return, and in line with international central banking practice, is considered to be a fundamentally conservative investor. It mitigates the arising risks (credit risk, market risk, liquidity risk) by applying a strict limit system.

The portfolio should be analysed from a policy perspective on the one hand and from a financial risk perspective on the other. An example of the former is that the MNB supports green bond markets and, in general, issuers' access to the market by creating demand, while giving priority to the above reserve maintenance objectives. With these considerations in mind, the MNB is among the first central banks to have established a dedicated portfolio of green bonds, which it monitors for their positive environmental impacts.

The financial risk effects appear in the case of portfolios in such a way that physical or transition risks can represent market and credit risks through the increase in spreads or the deterioration of probability of default. In this context, it is worth distinguishing between two approaches.

- **Short term:** The MNB's investment horizon is fundamentally short; its portfolio is protected against the potential financial impacts of climate risks on this short time horizon. Firstly, climate risks will have an increasingly significant impact over a time horizon of several decades, and, secondly, the MNB mainly holds the sovereign debt of developed, highly rated countries and the exposures are well diversified. On the one hand, this means that the risk of default is low, and on the other hand, the risk of repricing is also low because of the short-term exposures.

- **Long term:** The current structure of the reserves allows the MNB to develop its long-term strategy without a rapid and drastic reallocation of the portfolio. As time passes, it will become increasingly important to make appropriate, gradual steps also in the reserves. Climate risk exposure can be managed with simpler limits (e.g., concentration limits, exclusions), but more complex models also need to be implemented (climate risk budget, VaR, green benchmark). As the market evolves and international best practices become more established, the scope and reliability of the data available may improve, which is a prerequisite for further steps to be taken.

In the traditional risk management framework, daily limit monitoring is in place and monthly, quarterly and semi-annual reporting support the work of the decision-making. The integration of climate risks into this framework is ongoing; as a first step, the carbon intensity of sovereign exposures in the foreign exchange reserves has been regularly reported to decision-makers; from 2023 onwards, this has been extended to include the sustainability risks on corporate exposures in the reserves.

3.3 FINANCIAL STABILITY

Climate-related risks affect the MNB not only via its balance sheet. Climate change effects may spill over into the financial system via the real economy, causing losses first to economic actors and then to investors and creditors. For example, the losses of credit institutions, whether concentrated in one institution or affecting the entire banking sector at once, can have serious consequences. The MNB, as the authority responsible for the stability of the financial system, monitors these developments.

The MNB measures the sustainability risks of the financial system using a number of methodologies and processes. For example, the *Bank Carbon Risk Index* can be used to monitor the evolution of the transition risks of the entire banking sector (or individual institutions) on a quarterly basis. This process is supported by various climate stress tests, including a short-term climate stress test carried out by the MNB following the long-term climate stress test conducted in 2021.

The individual assessment of financial institutions is gradually being integrated into micro-prudential supervisory activity. From 2021, since the first edition of the Green Recommendation, the MNB started to monitor and analyse the preparedness and attitudes of Hungarian credit institutions towards environmental sustainability aspects at institutional level (by means of self-assessments, own action plans and prudential discussions). If the degree of compliance with these recommendations improves in the Hungarian banking sector, the level of climate risk to the financial system may also decrease, as well as the probability of a shock-like reaction to new, stricter regulations.

The financial risks of biodiversity loss are being addressed by the MNB in an international project. In order to make progress in the identification and measurement of broader environmental risks, from September 2022, the MNB works with experts from the OECD Committee on Financial Markets, the European Commission and selected commercial banks, with the aim of assessing the financial risks, impacts and interactions arising from biodiversity loss and developing a regulatory framework.

3.4 THE MNB'S OWN OPERATIONS

Climate risks affect the operational risk profile of the MNB. Both transition and physical risks are relevant for the MNB and need to be considered when creating and operating the operational risk management framework. Activities related to operational risk management and business continuity management are decentralized within the MNB, where a dedicated department plays a coordinating role and provides methodological guidance.

International best practices are applied in the management of operational risks: operational risks are assessed in the context of processes and a bank-wide risk map is drawn up on that basis. This is also supported by an event register of the relevant losses, about which an annual summary statement is provided to senior management. Where climate risks become relevant for a workflow, they are analysed as part of the normal operational risk management workflow.

A key area of operational risk management is business continuity, which can be severely affected by physical risks. Chance and unavoidable external circumstances also play a role in the occurrence of risk events, which can cause uncertainty in the operation of the MNB. The aim of operational risk management is to effectively manage this uncertainty and provide decision-making processes with the widest possible range of information. The direct risks arising from the MNB's operations may be affected by the effects of climate change and environmental degradation, such as the negative impact on the MNB's buildings, for example high summer temperatures, which can damage the operational infrastructure, making business continuity difficult.

The MNB's operations generate GHG emissions and other environmental burden, which may have a negative impact on the environment and thus pose a potential reputational risk to the Bank. The MNB seeks to manage its impact on the environment primarily by measuring and reducing its carbon footprint.

Transition risks may have an impact on changes in the price of energy used or business travel, which can lead to higher operating costs. This type of materialization of climate risks needs to be taken into account when planning costs.

4 Climate risk indicators

This report presents a qualitative and quantitative assessment of the climate risks associated with the MNB's balance sheet and its own operations. For an analysis of the financial stability aspects of the climate risks of the financial system, see the Green Finance Report[13].

4.1 COVERAGE OF THE ASSETS ANALYSED

The MNB aims to include the widest possible range of its assets in its climate risk analyses. Regarding the foreign exchange reserves, the focus of the analysis is on sovereign exposures, representing the core of the reserves, but the MNB also conducts analyses in the case of other positions. In respect of monetary policy instruments, the analysis also covers mortgage bonds and corporate exposures in addition to sovereigns.

- **Foreign exchange reserves:** the bulk of the reserve portfolios consist of sovereign exposures, but they also include issuances by international (supranational) institutions, highly rated corporate and bank issuances and covered bonds. The portfolio also includes gold reserves and other money market and derivative instruments, which are not included in the climate risk analysis.

- **Funding for Growth Scheme (FGS):** FGS was launched in 2013 to restore the functioning of the SME lending market. Under the programme, the MNB provided funds to participating credit institutions at an interest rate of 0 per cent, which they could re-lend to micro, small and medium-sized enterprises at a maximum interest rate of 2.5 per cent, up until 2021.

- **Bond Funding for Growth Scheme (BGS):** launched by the MNB in 2019 as a result of a capital market development strategic decision to increase liquidity in the corporate bond market. Under the programme, the MNB purchased bonds issued by non-financial corporates with good credit ratings in the period until 2021.

- **Government Securities Purchase Programme (GSPP):** The MNB had been buying Hungarian government bonds on the secondary market since 2020 to address the adverse effects of financial market turbulence on domestic markets. Although the MNB stopped purchases in December 2021, it continues to hold government securities with long maturities on its balance sheet.

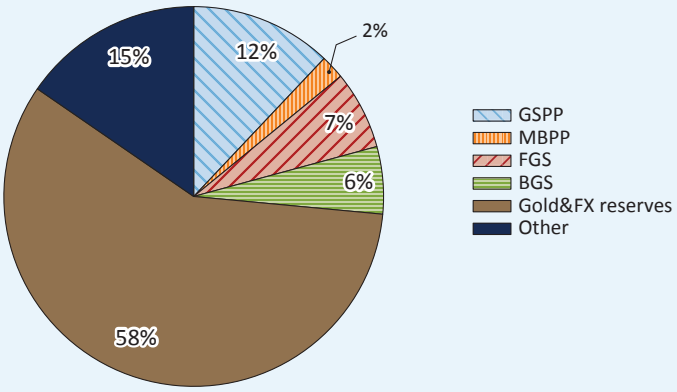
- **Mortgage Bond Purchase Programme (MBPP):** first launched in 2018, under which the MNB purchased from Hungarian mortgage institutions fixed-rate mortgage bonds denominated in HUF. The Green Mortgage Bond Purchase Programme (GMBPP) was launched in 2021 and closed in May 2022, following the tightening measures taken by the central bank.

- **Green Home Programme (GHP):** launched as part of the FGS scheme, the programme promoted the creation of a green housing loan market and the mainstreaming of environmental sustainability considerations in the domestic housing market by providing low-interest central bank funding. The HUF 300 billion programme ended at the end of September 2022.

- **The MNB also assumes indirect risks when managing collateral.** The MNB practically accepts the issuances of the entire Hungarian bond market as collateral in addition to large corporate loans, where – due to the structure of the market – government securities dominate the pledged collateral. The range of eligible securities is relatively wide, with government, corporate and bank securities (including mortgage bonds) in the eligible portfolio.

[13] The MNB's Green Finance Report

Chart 2
Asset side of the MNB's balance sheet (2023)*



**Note: based on preliminary 2023 year-end balance sheet data*
Source: MNB

4.2 METHODOLOGY AND DATA SOURCES

The MNB analyses the climate risk exposure of its financial asset portfolios in terms of transition risks and physical risks.

- The primary indicator used by the MNB for measuring **transition risks** is Weighted Average Carbon Intensity (WACI), in a production and consumption approach, and aims to align it as closely as possible with the ECB's common methodology[14] published in 2023. The analysis was supplemented with forward-looking indicators such as Implied Temperature Rise (ITR), the Bloomberg Government Climate Risk Scores and the MSCI Sovereign CvaR.

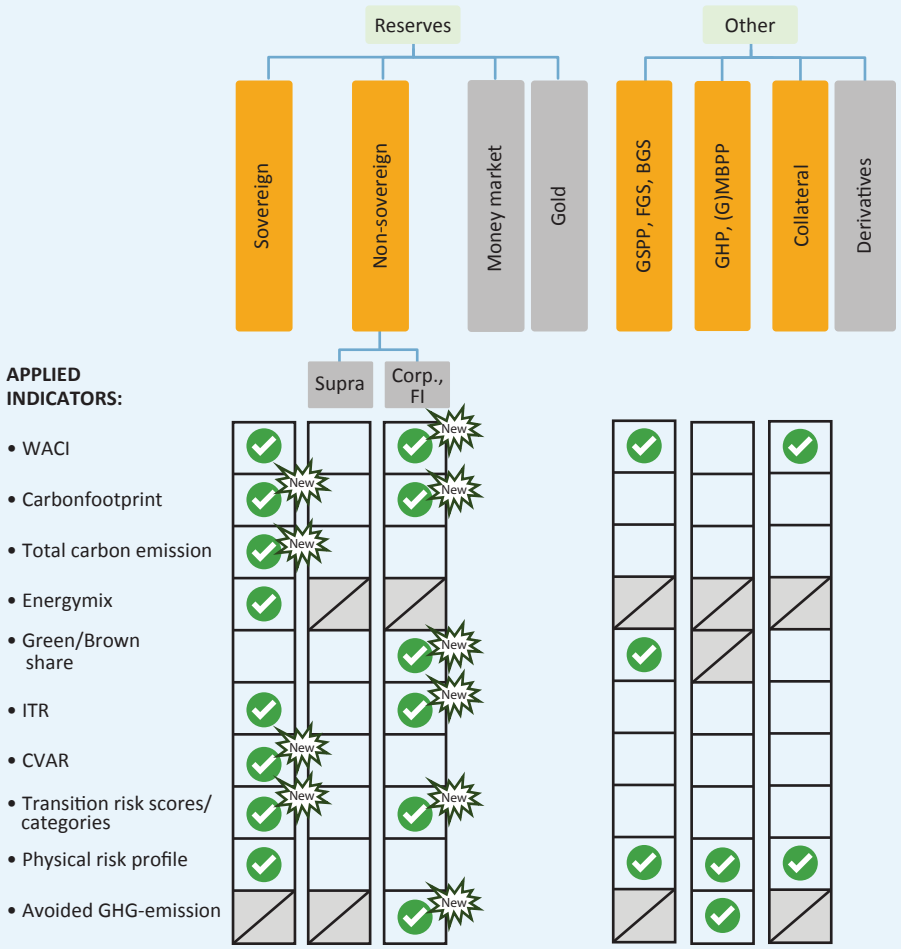
- Assessing **physical risks** involves significant technical and methodological challenges, including the need for detailed geographical data to determine the severity of potential weather events occurring at different locations. The MNB uses data and models from Moody's Analytics to analyse physical risks.

Although most of the indicators operate with a number of complex methodological assumptions, the results provide a useful guide to better understand which parts of the balance sheet are most exposed to climate risks.

The analyses are based on preliminary balance sheet data as of the end of 2023 and the latest annual GHG emissions and corresponding GDP data available from the data providers. For detailed methodological descriptions, see the Annex.

[14] Overview of Eurosystem climate-related financial disclosures

Chart 3
Asset categories covered in the TCFD report and the set of metrics used for their analysis



4.3 CLIMATE RISK ANALYSIS OF THE MNB'S FINANCIAL INSTRUMENTS

4.3.1 Transition risks

4.3.1.1 Sovereign exposures of the foreign exchange reserves

The central banks of the euro area published their first climate-related financial disclosures in 2023, using a common methodology in their calculations.

The MNB has made a number of changes to the methodology it had used previously for the analysis of sovereign assets, adapting it to the above practice. In addition to WACI – as the main transition risk indicator – the total carbon emissions and the carbon footprint of sovereign portfolios were calculated, both in terms of the production and consumption approaches. For the sake of comparability over time, the figures were also calculated retrospectively for 2022, using the new methodology.

The carbon intensity of the sovereign exposure of the reserve portfolios was 247 tonnes of CO_2e per million euros of GDP, based on the production approach in 2023 (Table 1). The indicator declined compared to the previous year, due to a decrease in GHG intensity in some countries and a slight structural shift within the portfolio towards EU countries.

In both the production and the consumption approaches, the carbon intensity of the foreign exchange reserves show a lower level than the IMF COFER[15], chosen as the reference portfolio.

Table 1
Emission indicators for the sovereign exposure of foreign exchange reserves

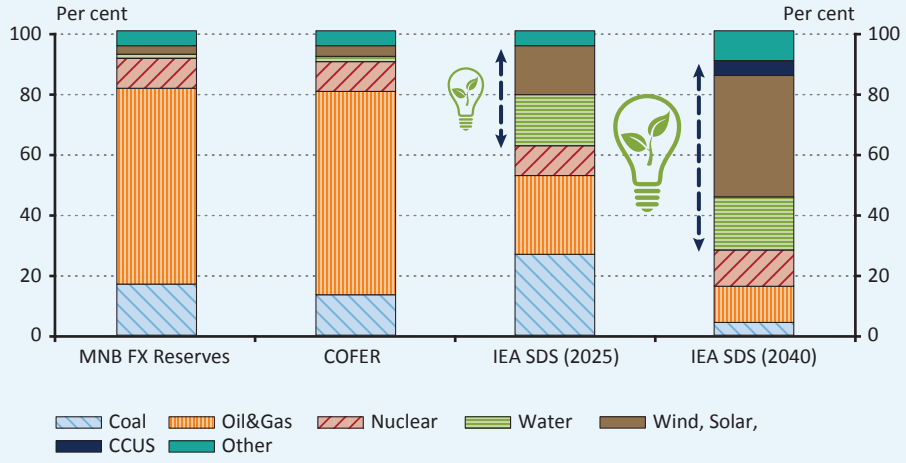
Consumption approach	2022	2023	Production approach	2022	2023
WACI	14 *(tCO_2e/capita)*	13 *(tCO_2e/capita)*	**WACI**	265 *(tCO_2e/ m€ GDP)*	247 *(tCO_2e/ m€ GDP)*
Total carbon emissions	3 036 235 *(tCO_2e)*	3 086 323 *(tCO_2e)*	**Total carbon emissions**	2 647 177 *(tCO_2e)*	2 742 124 *(tCO_2e)*
Carbon footprint	304 *(tCO_2e/ m€ GDP)*	279 *(tCO_2e/ m€ GDP)*	**Carbon footprint**	265 *(tCO_2e/ m€ GDP)*	247 *(tCO_2e/ m€ GDP)*

Source: MNB's own calculations based on data from the World Bank, MSCI[16]

The analysis examined the energy mix of issuers of sovereign securities included in the foreign exchange reserves. We consider the IMF COFER and the Sustainable Development Scenario (SDS) published by the International Energy Agency (IEA) as a basis for comparison. The latter represents the profile of the global aggregate energy composition needed to achieve a sustainable transition.

The current energy mix of the countries in the portfolio is almost identical to that of the IMF COFER which approximates the world's foreign exchange reserves, but at the same time differs substantially from the composition deemed necessary in the IEA sustainability scenario; due to the dominance of natural gas and oil.

Chart 4
Energy mix of sovereign issuers of foreign exchange reserves[17]



Source: MNB calculation based on 2022 energy production data from the IEA

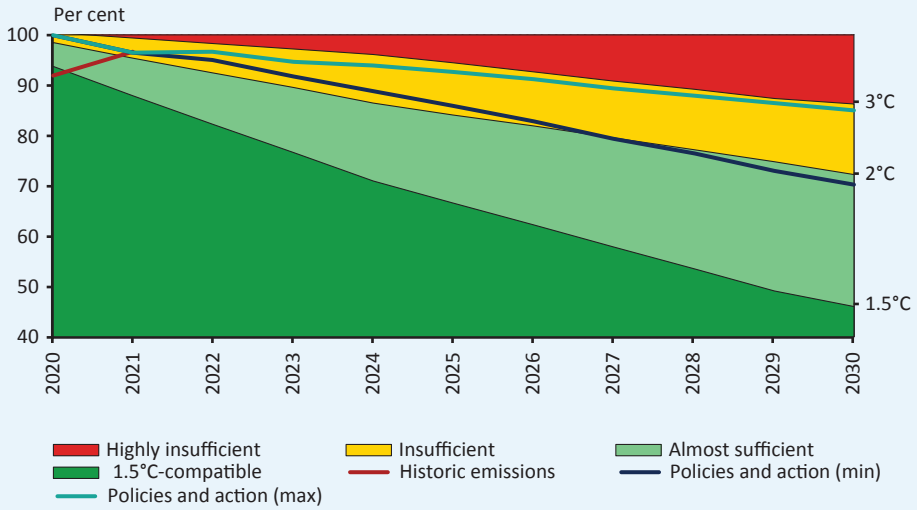
[15] To manage the foreign exchange reserves portfolios, the MNB uses market bond indices, which are tailored to the needs of the Bank. The MNB did not use the portfolio management benchmarks as a reference for the calculation of the WACI metric, as they were designed without taking into account climate risk considerations. Instead, COFER, a portfolio representing the currency composition of official IMF foreign exchange reserves was used.

[16] It should be noted regarding all the MSCI data presented in this report that MSCI ESG Research LLC. obtains the information from sources it believes to be reliable but disclaims all warranties, express or implied, as to the authenticity, completeness or accuracy of such information. None of the data should be used on its own to determine which securities to buy or sell, or when to buy or sell them. None of the information constitutes investment advice or a recommendation to make (or refrain from making) any investment decision and should not be relied upon as such. Details on the use of the data can be found at the link below: https://www.msci.com/notice-and-disclaimer-for-reporting-licenses

[17] CCUS: innovative technologies to reduce GHG emissions (CO_2 capture, use and storage).

A similar picture emerges from the calculations based on Climate Action Tracker (CAT) data: the combined weighted emission trajectories of the countries in the reserve do not meet the pro-rata Paris climate targets in either scenario (full or partial fulfilment of national commitments); the portfolio remains in the "*almost sufficient*" and "*insufficient*" categories. It is important to note that, based on the CAT analysis, none of the countries in the investment universe relevant for reserve management are meeting the Paris climate targets.

Chart 5
Emission trajectories of the sovereign portfolio and pro-rata compliance with the Paris climate targets
(2019 emissions = 100%)

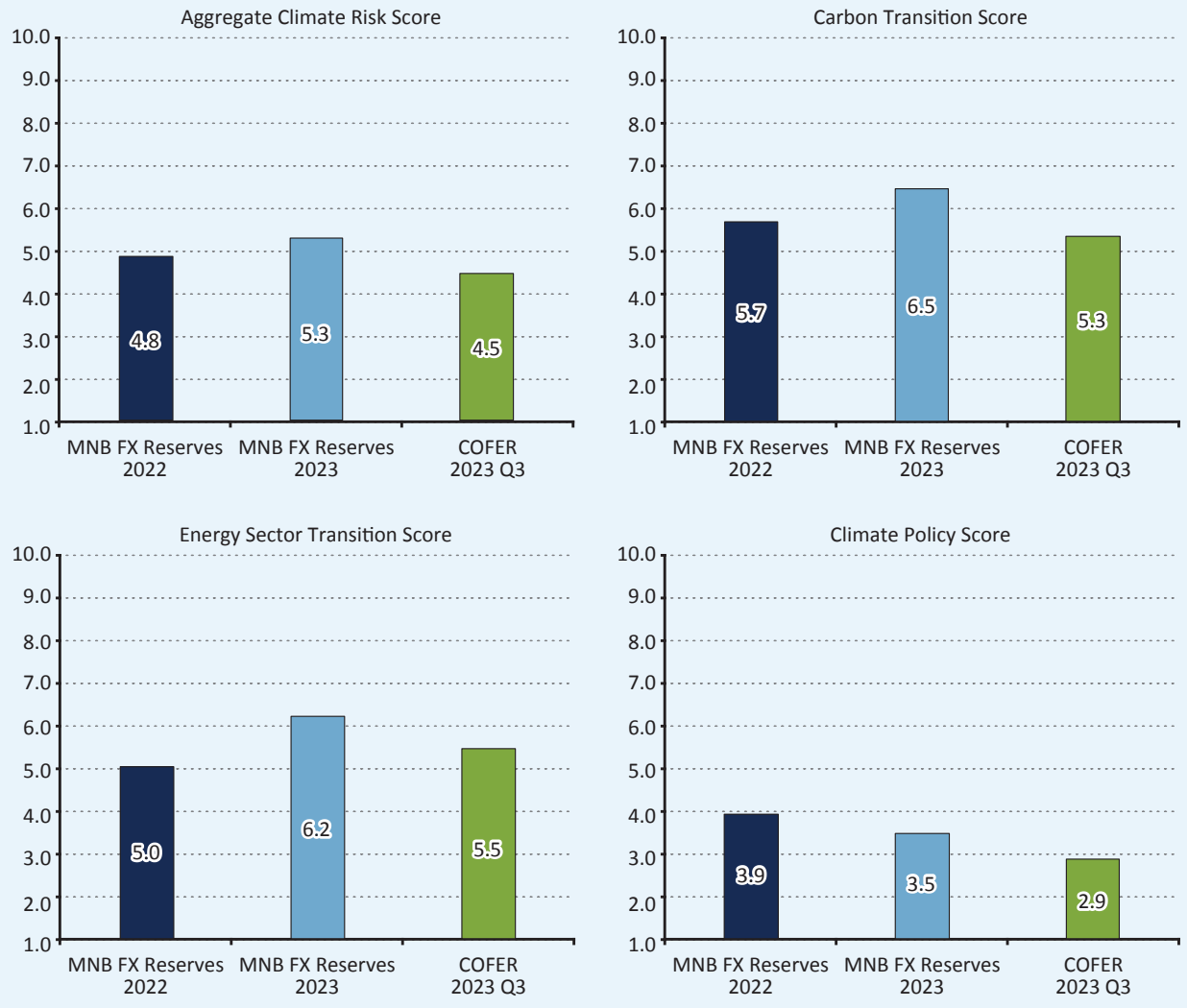


Source: MNB calculation based on Climate Action Tracker 2023 climate scenario data

Based on *Government Climate Risk Scores*, the countries of the sovereign exposures of the foreign exchange reserves are relatively better prepared for the climate transition than the COFER, but at the same time, there is a lag compared to the theoretical best values according to the methodology. The methodology evaluates the transition risks of individual countries related to climate change in 3 dimensions, on a scale of 0-10 (10 being the best value).

- *Carbon Transition Score:* assesses a country's past, present and prospective GHG emissions.
- *Power Sector Transition Score:* assesses a country's progress and future efforts to decarbonize its energy sector, taking into account the current share of fossil fuel and renewable generation and the level of clean energy investments.
- *Climate Policy Score:* evaluates a country's progress in achieving net zero goals and in developing frameworks related to green debt issuance and renewable energy policy.

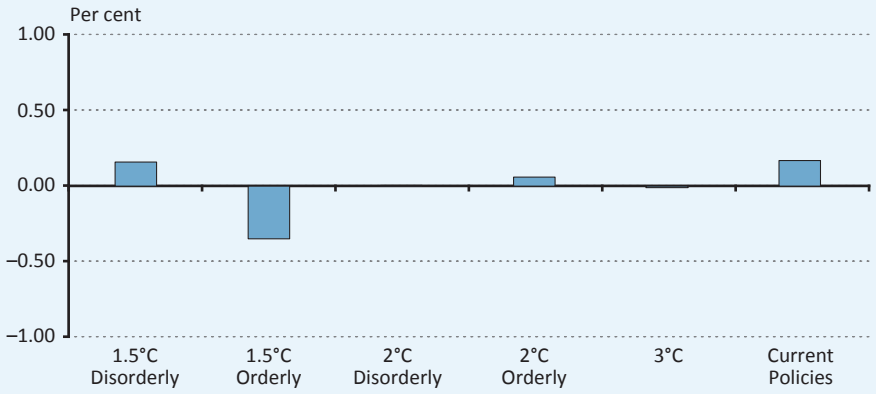
Chart 6
Government Climate Risk Scores of the sovereign portfolio and the COFER



Source: MNB calculation based on Bloomberg Finance L.P. data

***Sovereign Climate Value-at-Risk* (CVaR) methodology developed by MSCI ESG Research examines the financial impact of various NGFS stress scenarios on the valuation of the sovereign portfolio.** Depending on how the transition to a sustainable economy takes place, the individual scenarios assume different changes in the development of interest rates, which affect the pricing of financial instruments. The "orderly" scenarios assume that climate policies are introduced early and gradually become stricter. Both physical and transitory risks are relatively subdued. The "disorderly" scenarios assume a higher transition risk due to delayed or different climate policies between countries and sectors. Long-term interest rates tend to rise in transition scenarios, reflecting rising carbon prices and inflation due to the increased investment demand required for the green transition.

Chart 7
Impact of NGFS interest rate scenarios on the value of sovereign exposures in the foreign exchange reserves



Source: MNB calculation based on MSCI data

Overall, despite the fact that the emission trajectories of the countries in the sovereign portfolio do not meet the Paris climate targets, the portfolio is largely protected from climate risks, mainly due to its short duration. Moreover, the countries in the reserve are the world's leading economies, with high credit ratings and considerable capacity for adaptation.

4.3.1.2 Government Securities Purchase Programme

Hungary's emissions profile was used as the basis for our analysis of the transition risks of the GSPP portfolio. Hungary's WACI metric, in the production approach, is 213 tonnes of CO_2e per million euro of GDP, slightly lower than in the previous year. The consumption-based carbon intensity has not changed significantly, it is 6 tonnes CO_2e per capita.

Table 2
Carbon intensity indicators for Hungary

Consumption approach	2022	2023	Production approach	2022	2023
WACI	6 *(tCO_2e/capita)*	6 *(tCO_2e/capita)*	**WACI**	216 *(tCO_2e/ m€ GDP)*	213 *(tCO_2e/ m€ GDP)*
Total carbon emissions	1 692 552 *(tCO_2e)*	1 727 098 *(tCO_2e)*	**Total carbon emissions**	1 786 194 *(tCO_2e)*	1 839 484 *(tCO_2e)*
Carbon footprint	205 *(tCO_2e/ m€ GDP)*	200 *(tCO_2e/ m€ GDP)*	**Carbon footprint**	216 *(tCO_2e/ m€ GDP)*	213 *(tCO_2e/ m€ GDP)*

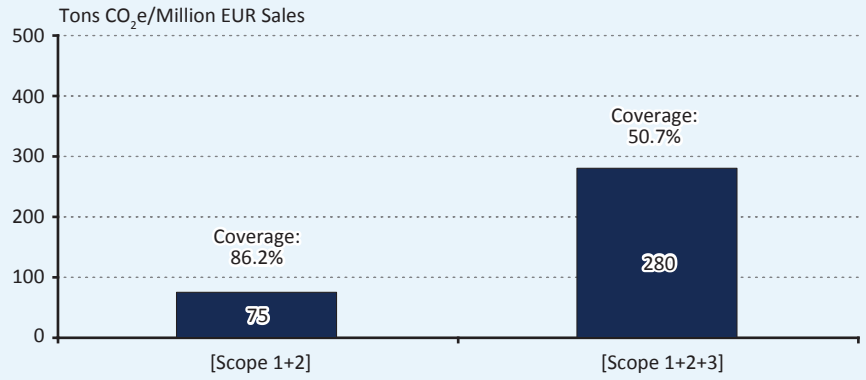
Source: MNB calculation based on MSCI and World Bank data

4.3.1.3 Corporate exposures in the foreign exchange reserves

In 2023, the sustainability risk analysis framework was extended to include an evaluation of corporate exposures in the reserve. For the carbon intensity indicator, the financed GHG emissions are expressed in relation to the revenue generated by the company[18].

The direct (Scope 1+2) carbon intensity of the corporate exposure of the reserve portfolios was *75 tonnes CO_2e per million euros of sales revenue* in 2023, with 86.2 per cent coverage. With indirect emissions data (Scope 3) also included, total emissions are more than four times higher, but in this case the data coverage is only 50.7 per cent.

Chart 8
Carbon intensity in the corporate portfolio



Source: MNB calculation based on Bloomberg Finance LP. Data

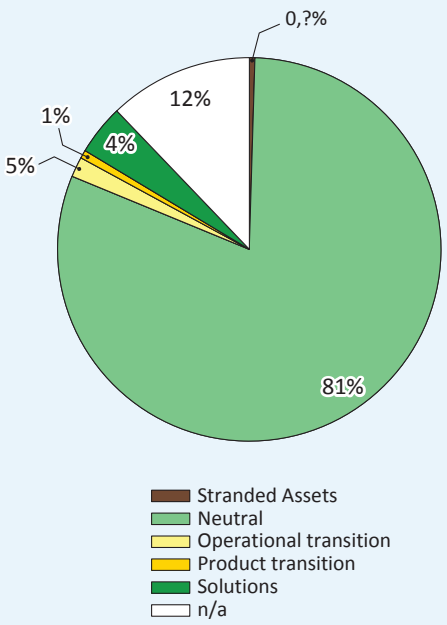
According to the MSCI's *Low Carbon Transition Management* methodology, the proportion of issuers with significant transition risk in corporate portfolios is marginal, representing only 2.86 per cent. MSCI classifies companies into different categories based on their current emissions profile. According to the methodology, companies face significant transition risks if their assets are potentially stranded assets' or if they need to take additional steps in their operational transition or product transition as demand for GHG-intensive products falls.

The vast majority of the portfolio falls into the Neutral category, with limited exposure to transition risks 4.23 per cent of the portfolio falls into the "Solutions" category, which have the potential to benefit from the growth of products and services with low GHG emissions. The coverage of the indicator is 87.85 per cent. (Chart 9)

Based on the *MSCI Implied Temperature Rise* (ITR) indicator, 61 per cent of the corporate portfolio meets the climate targets. The ITR is a forward-looking measure, expressed in degrees Celsius, that shows companies' alignment with the targets set out in the Paris Climate Accords. Although the majority of the issuers in the corporate portfolio are aligned with such climate targets, 14 per cent need to take further action to reduce their emissions. The coverage of the indicator is 75 per cent (Chart 10).

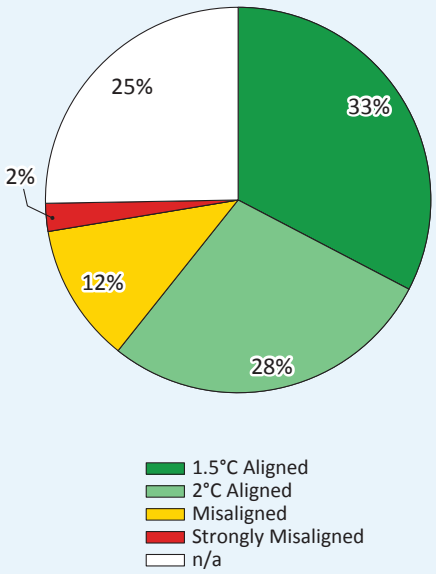
[18] The data providers use the emissions data reported by the companies where such data is available; if not, they will use estimates based on their own methodologies.

Chart 9
Transition risk categories



Source: MSCI

Chart 10
Implied temperature rise



Source: MSCI

The sustainability risk analysis framework also includes the examination of certain positive and negative screening indicators. **The *positive screening* indicators show that a significant proportion of issuers in the corporate portfolio of the foreign exchange reserves are already making some sort of climate risk or sustainability commitments.** These indicators reflect whether a company is making a positive contribution to promoting sustainable development. Examples include being signatory to the UN Global Compact[19], which is positive for 39 per cent of the portfolio, and publishing voluntary emission reduction commitments, concerning which we have information on 44 per cent of the portfolio. Issuers representing 16 per cent of the portfolio have ESG rating[20].

The *negative screening* indicators do not indicate problematic entities in relation to corporate issuers. These indicators capture a company's negative exposure to sustainability risks. Based on the available sources of data, we are not aware of any information suggesting that any particular company would be involved in significant environmentally harmful activities or in serious violation of the UN Global Compact guidelines.

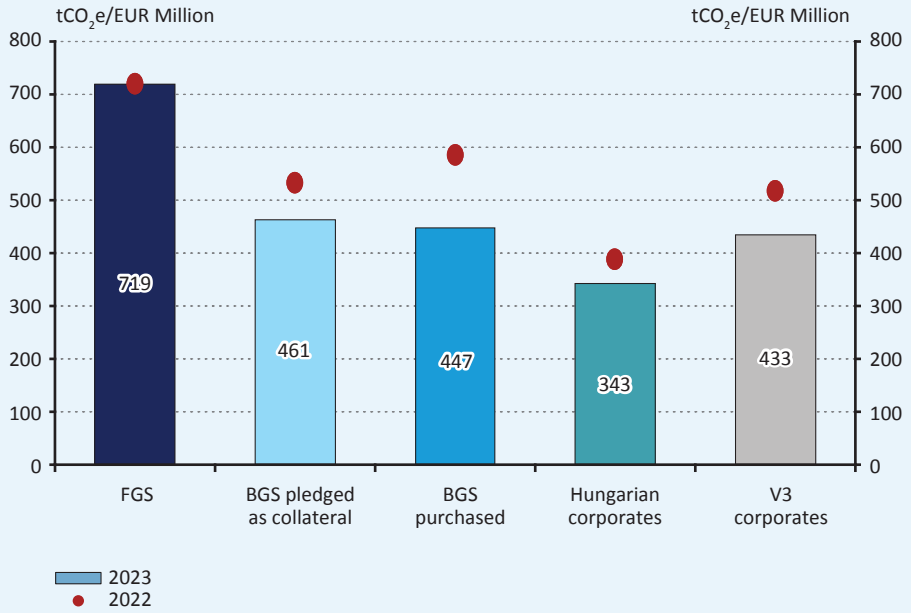
The MNB also monitors various exclusion-type indicators too. Based on these indicators the involvement of corporate exposures of the foreign exchange reserves is marginal, no substantial risk exposure arises. Examples of such indicators include the MSCI's *Exclusion from Paris-aligned benchmark* indicator, which shows whether a company's activities fall within the scope of the exclusion criteria in the EU Paris-aligned Benchmark Regulation[21], and a list of companies published by Norges Bank Investment Management, that are excluded from its investment universe for some reason[22].

[19] United Nations Global Compact participants
[20] MSCI ESG rating
[21] In 2020 the European Commission set the criteria for the EU Climate Transition Benchmark and the EU Paris-aligned Benchmark. Labelled CTB and PAB, these indices approximate the trajectory along which the index may reach the Paris Accords target of 1.5°C, relative to the initial baseline of the index. Article 12 of the Regulation lists the criteria under which a company must not be included in indices so designated.
[22] The exclusion criteria are determined by the Council on Ethics of the Norwegian Ministry of Finance.

4.3.1.4 Bond Funding for Growth Programme

The average carbon intensity metric of the BGS portfolio is 447 tonnes of CO_2e per million euros of value added, which is higher than the value of the Hungarian corporate sector as a whole, but closer to the average corporate carbon intensity of the V3 countries[23]. The year-on-year decrease in the indicator is due mainly to the fall in the GHG intensity of the petroleum refining sector.

Chart 11
Carbon intensity of the FGS and BGS bond portfolios, and Hungarian and V3 companies

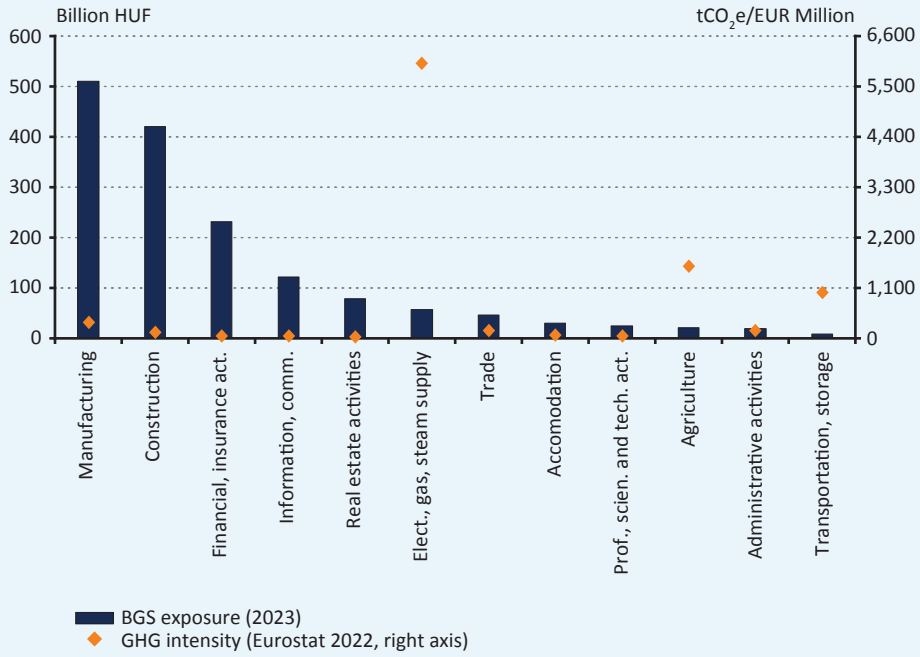


Source: MNB calculation based on Eurostat data

The most carbon-intensive sector in the portfolio is electricity, gas, steam and air-conditioning, but its combined weight is only 4 per cent (Chart 12). The carbon intensity of this section nevertheless contributed significantly to the weighted carbon intensity (196 tonnes of CO_2e per million euro of value added), as the GHG intensity of this sector is extremely high at 6,001 tonnes CO_2e per million euro of value added.

[23] V3 countries refers to the members of the Visegrád Cooperation (V4) other than Hungary: Czech Republic, Poland and Slovakia.

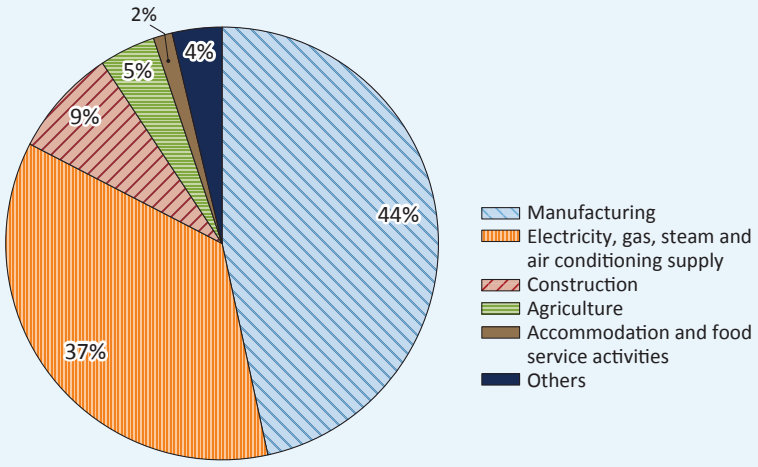
Chart 12
Sectoral distribution of the volume of the BGS portfolio (left) and the carbon intensity of sectors (right)



Source: Eurostat, MNB

Three sectors (electricity, gas, steam and air-conditioning, manufacturing and construction) contributed 90 per cent of the portfolio WACI (Chart 13). The high value of electricity is mainly explained by the high GHG intensity of the sector, while for manufacturing and construction by their high weight in the portfolio.

Chart 13
Contribution of the main sectors to the GHG intensity of the BGS portfolio



Source: Eurostat, MNB

At the end of 2023, the brown share of the BGS portfolio was 13.5 per cent. It is also important to note that, while this is not a dedicated purpose of the BGS, the MNB also purchased green corporate bonds under the programme. The share of green bonds (green share) in the BGS portfolio exceeds 20 per cent. The largest issuers were construction, manufacturing and real estate development companies.

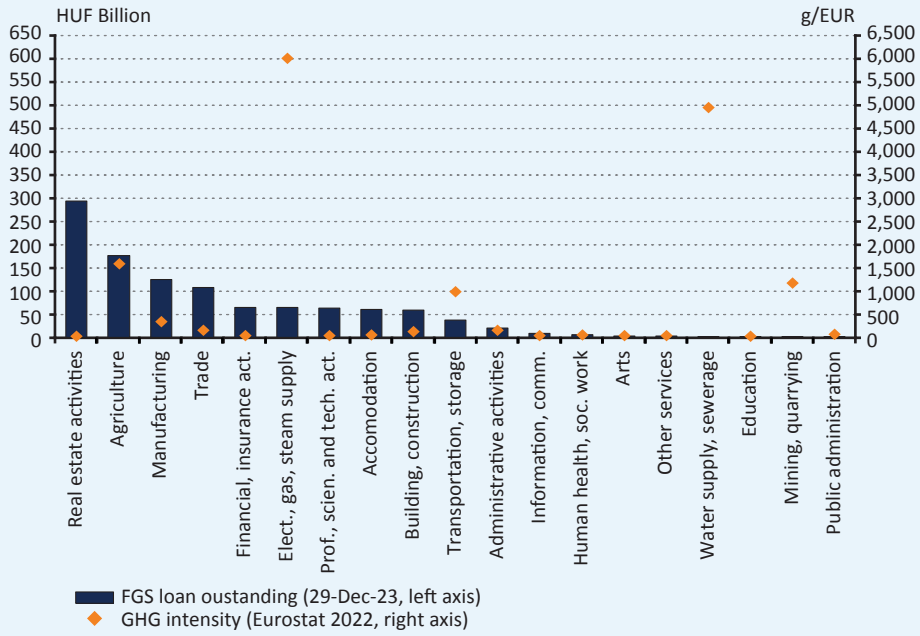
The collaterals pledged to the MNB are dominated by government securities; BGS accounts for only a smaller proportion (of around 15 per cent). At the end of 2023 the average carbon intensity of the pledged BGS exposures was 461 tonnes of CO_2e per million EUR of added value. The indicator is below the carbon intensity of the FGS portfolio but slightly above the WACI of the BGS exposures in the MNB portfolio. The scope and stock of purchased and pledged securities differ.

4.3.1.5 Funding for Growth Scheme

The WACI of the FGS portfolio is 719 tonnes of CO_2e/million euros of added value. The carbon intensity of the portfolio exceeds both the average corporate carbon intensity of the Hungarian corporate sector as a whole and that of the V3 countries (Chart 11). The minimal year-on-year change in the indicator is attributable to a changing sectoral composition due to repayments.

Within the outstanding stock of loans under the FGS, the weight of carbon-intensive sectors can be considered low, with only 6 per cent of the total portfolio linked to these sectors at the end of 2023.

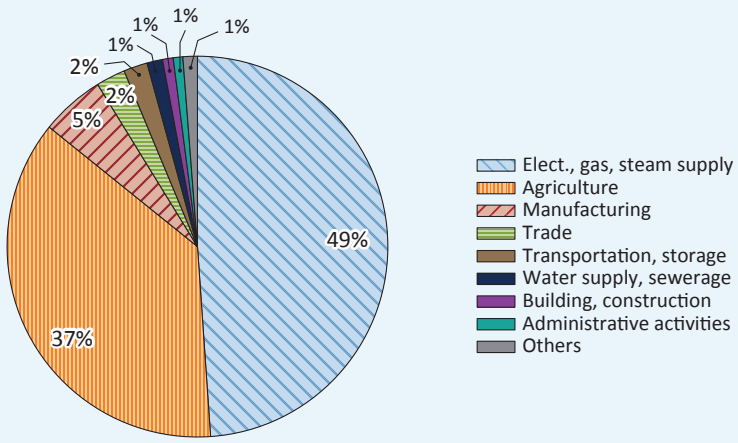
Chart 14
Sectoral distribution of the FGS portfolio and GHG intensity of each sector



Source: Eurostat, MNB

Only five sectors contributed to 96 per cent of the carbon intensity of the FGS portfolio: electricity generation, agriculture, manufacturing, trade, and transport and storage (Chart 15). The high contribution of the agriculture, the electricity generation, and the transport and storage sectors is attributable mainly to the high GHG intensity of these sectors, while the high contribution of the manufacturing and trade sectors can be explained by the high weight of these sectors within the portfolio.

Chart 15
Contribution of the main sectors to the GHG intensity of the FGS portfolio



Source: Eurostat, MNB

4.3.2 Physical risks

The sovereign exposure of the foreign exchange reserves consists primarily of issuances from developed economies, and thus the physical risk profile is determined by data typical to the world's leading economies. The physical risk profile of the portfolio did not change significantly compared to the previous year, with sea level rise, floods and heat stress remaining the most relevant risk factors. The portfolio carries medium risk in the categories of hurricane and typhoon and drought, and relatively low risk in the wildfire category (Chart 17).

Chart 16
Physical risks of sovereign exposures in the foreign exchange reserves by risk category (% portfolió weight)

	Risk level				
Risk factor	**None**	**Low**	**Medium**	**High**	**Very High**
Flood	0%	0%	17%	50%	33%
Heat Stress	17%	33%	23%	26%	0%
Hurricane & Typhoon	24%	22%	0%	54%	0%
Sea level rise	2%	8%	8%	16%	66%
Drought	10%	36%	19%	35%	0%
Wildfire	18%	47%	35%	0%	0%

Source: MNB calculation based on Moody's Analytics data

In the case of the monetary policy portfolios (BGS, FGS, GSPP, MBPP, GMBPP), the physical risk profile of Hungary is considered to be the benchmark, taking into account Hungary's relatively small geographical extent.

The Hungarian sovereign physical risk levels are substantially lower than the overall risks of the foreign exchange reserves. Only heat stress represents high risk, whereas, the risk categories sea level rise, and hurricanes and typhoons are not relevant, given Hungary's geographical location. The level of wildfire risk is roughly the same as seen at the sovereign portfolio of the foreign exchange reserves.

Chart 17
The physical risk profile of Hungary

	Risk level				
Risk factor	**None**	**Low**	**Medium**	**High**	**Very High**
Flood					
Heat Stress					
Hurricane & Typhoon					
Sea level rise					
Drought					
Wildfire					

Source: MNB calculation based on Moody's Analytics data

4.3.3 Avoided GHG emissions

For some portfolios, the environmental impact analysis of the programmes and the assessment of the expected or realized positive environmental impacts are also of particular importance. The environmental impacts known at the level of individual emitters allow the portfolio to be assessed not only in financial terms but also in terms of the emission reductions achieved, while also maintaining the primary financial objectives.

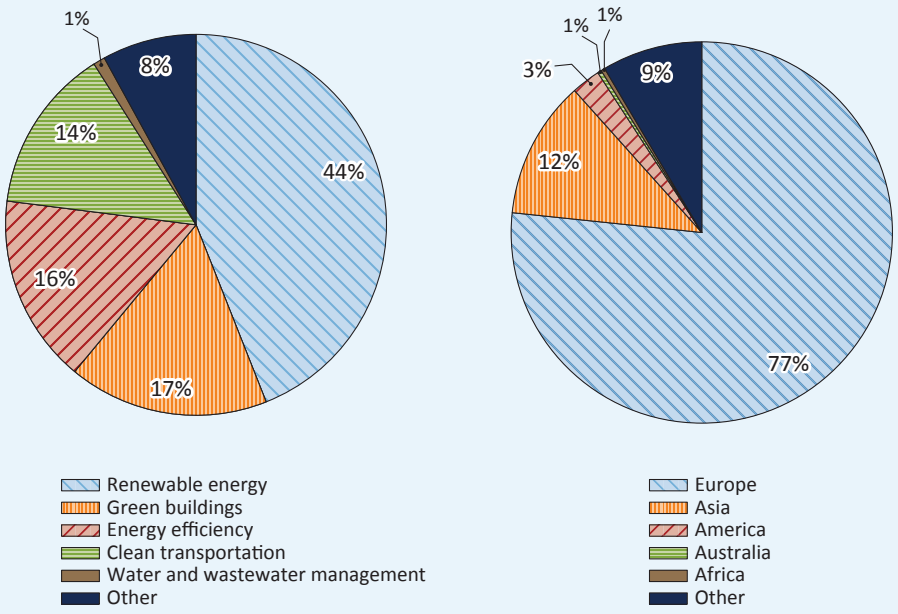
A possible approach to achieve this is to estimate the avoided GHG emissions. For the analysis, calculations are available for the green bond portfolio, MBPP/GMBPP and GHP, for example through the impact reports of the issuers in the portfolios.

4.3.3.1 Dedicated green bond portfolio

At the end of 2023 there was more than EUR 1.22 billion of exposure to green or sustainability-labelled bonds within the foreign exchange reserves. This included a dedicated portfolio of green bonds, the positive environmental impact of which is monitored separately by the MNB. In the case of green bonds, the funds raised are invested by the issuer in specific projects that are beneficial from an environmental and energy efficiency perspective. Green bonds facilitate the channelling of capital into green investments and may reduce the cost of access to finance.

More than half of the projects funded are renewable energy and green buildings. The green bond portfolio is denominated in euro, which reflects the predominance of European issuers and the geographical distribution of the green projects realized.

Chart 18
Type and geographic distribution of financed green projects



Source: Bond issuers' own reports

The positive environmental impact of projects financed by green bonds should always be interpreted against a baseline trajectory, which assumes hypothetical CO_2 quantities emitted in the absence of green projects. In 2023, this impact was 66,000 tonnes of GHG avoided in the portfolio, which is roughly equivalent to the annual carbon footprint of a Hungarian municipality of 13,000 inhabitants. The decrease compared to the previous year's figure (73,000 tonnes) is due to change in the structure of issuers within the green bond portfolio.

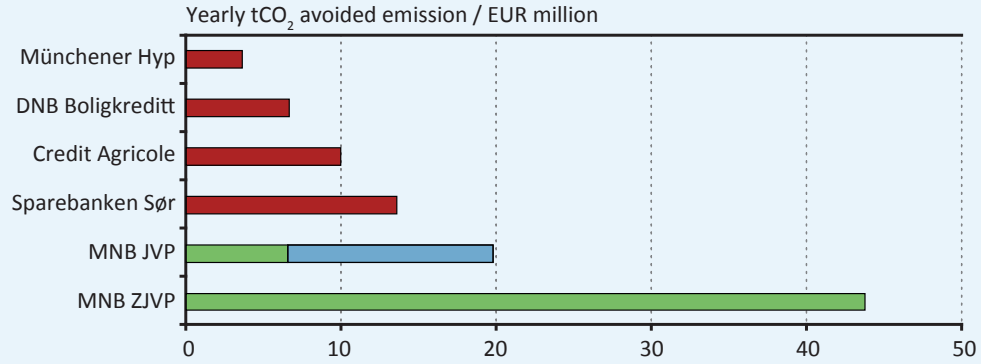
4.3.3.2 Mortgage Bond Purchase Programme

The MNB also seeks to analyse the environmental impact of its Mortgage Bond Purchase Programme. Mortgage bonds are special securities collateralized by at least 80 per cent of the principal repayments and interest payments on mortgage loans granted by mortgage banks and their partner banks, as required by law. The collateral for these loans is real estate; thus, the MNB's mortgage bond purchases indirectly finance the construction or purchase of real estate.

We estimate that the MBPP will save between 13 and 41 thousand tonnes of GHG emissions per year through the modernization of the housing stock, while the GMBPP will save 8.1 thousand tonnes of GHG emissions per year.

These values can be put into context by comparing them to indicators of green mortgage bonds issued in Western Europe (Chart 19). Overall, the MNB's programmes could achieve relatively high emission reductions per million euros. This may partly stem from the fact that, on the one hand, the Hungarian real estate portfolio is basically starting from a more outdated situation, and, on the other hand, domestic real estate is relatively cheaper, thus the amount of money invested may result in a greater reduction of emissions. It is also important to underline that mortgage bonds of different institutions may have different credit targets and property types, with different criteria, which also affect the reported results.

Chart 19
Specific emissions avoided per million euros in certain green mortgage bonds and the MNB programmes



Note: MBPP is shown at 2022 values; the light blue bar indicates the estimation band. The values shown have been calculated using different, individual estimation methodologies. In the case of GMBPP, green mortgage bonds purchased in the Program as well as purchases during subsequent renewals are also taken into account.

Source: MünchenerHyp, DNB, Sparebanken Sør, Berlin Hyp AG, OTP Jelzálogbank, Takarék Jelzálogbank, Unicredit Jelzálogbank, Erste Jelzálogbank issuers' own reports for 2023; MNB calculations

4.3.3.3 Green Home Programme

For the first time this year, the report includes an estimate of the climate impact of the GHP. The energy efficiency indicators and emissions factors of more than 8,600 properties built with GHP-funding were compared against the estimated average value of the Hungarian housing stock. The specific emissions value of the properties financed under the GHP is about one third of the average, which corresponds to an annual GHG-saving of 40 thousand tonnes.

4.4 EVOLUTION OF THE MNB'S CARBON FOOTPRINT

4.4.1 Operational activities

The MNB's target for the 2020-2022 cycle was to reduce its operational carbon footprint by at least 30 per cent compared to 2019; it managed to exceed this target, reducing its per capita carbon footprint by nearly 60 per cent by the end of 2022 compared to the baseline. According to preliminary[24] data, a further decline by 5 percentage points is expected by the end of 2023.

The energy crisis that started in 2022 prompted the MNB to voluntarily commit to the energy reduction targets announced by the government. The fine-tuning of operating practices at its two large office buildings (MNB Buda Centre, and the Supervisory Centre and Money Museum) and the implementation of an MNB-wide energy-saving programme it announced at the end of 2022 led to genuine reductions in energy consumption. According to the preliminary data for 2023, total energy usage at the two office buildings was 7.5 per cent lower than in 2022.

This reduction in carbon footprint was coupled with a fall in the amount of municipal waste thanks to the extension and continuous improvement of the selective waste collection system.

[24] not yet audited at the time of drafting the report

Table 3
Operational carbon footprint over time

Carbon emissions/sources	Evolution of the carbon footprint (t CO_2e)					Change in 2023, %	Change from base year 2019, %
	2019 base	2020	2021	2022	2023*		
Natural gas and district heating	848	966	981	1,975	1,127	-42.9	32.9
Vehicles fleet	123	104	104	116	122	5.57	-0.8
Refrigerants	-	5	5	3	2	-28.9	-
SCOPE 1 total	**971**	**1,076**	**1,091**	**2,094**	**1,251**	**-40.2**	**28.9**
Electricity	4,092	2,624	3,013	87	7	-91.8	-99.8
SCOPE 2 total	**4,092**	**2,624**	**3,013**	**87**	**7**	**-91.8**	**-99.8**
Air travel	945	201	33	411	811	97.1	-14.2
Business travel (abroad)	2.4	0.4	0.5	2.8	3.9	39.3	61.3
Business travel (domestic)	7.8	1.9	2.7	10.4	10.3	-1.0	32.2
Taxi	2.6	3.2	3.5	4.6	2.3	-50.0	-13.1
Banknote briquette (used as an energy source)	-	18	17	15	14	-8.5	-
Recycled paper	-	2	3	1	1	-31.5	-
Communal waste	-	156	110	61	57	-6.1	-
SCOPE 3 total	**958**	**383**	**170**	**506**	**899**	**77.7**	**-6.1**
SCOPE 1 - SCOPE 3 total	**6,021**	**4,082**	**4,273**	**2,687**	**2,158**	**-19.7**	**-64.2**
Carbon footprint (tons/employee)	**4.6**	**3.1**	**3.2**	**1.9**	**1.5**	**-20.6**	**-67.3**

** preliminary data*
Source: MNB

The MNB aims to reduce its carbon footprint from its operational activities, but this cannot be completely reduced. To compensate for emissions that cannot be further reduced, the MNB financed habitat restoration projects with the active involvement of WWF Hungary. Projects included planting a 27-hectare forest near the village of Geszt in the Körös-Maros National Park in 2022, and afforestation and grassland reconstruction on 32 hectares at Drávaszentes jointly with the Danube-Drava National Park Directorate in 2023.

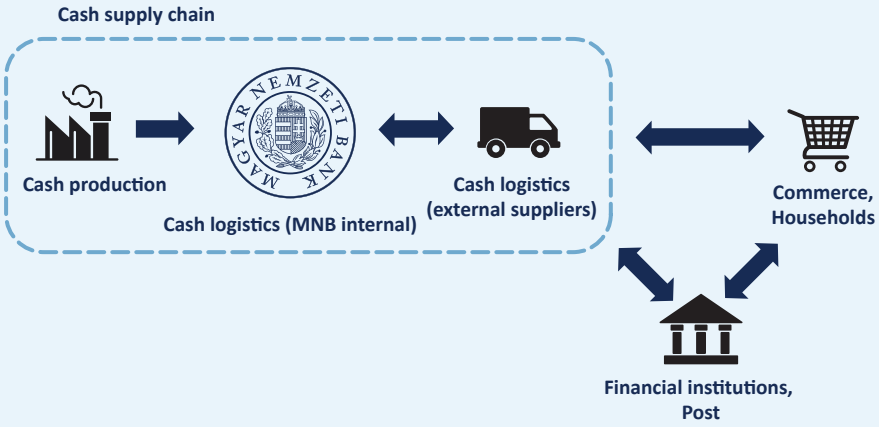
In addition to carbon offsetting, the projects also provide ecosystem services, including contributing to biodiversity conservation and mitigating the effects of climate change.

4.4.2 Carbon footprint of the cash supply chain

When measuring the environmental performance of the cash supply chain, the MNB focuses on the following activities:

- Cash production, the operations of the MNB subsidiaries involved in the production process
- Cash logistics activities within the MNB (distribution, processing)
- Activities of cash logistics service providers (suppliers)

Chart 20
The journey of cash across the economy



The MNB has quantified the carbon footprint of the cash supply chain. As a calculation basis, the model focused on the significant environmental emissions of each actor in terms of Scope 1 and Scope 2, after which the carbon footprint of the entire supply chain was calculated using the Bilan Carbone methodology and the relevant emission factors. It is important to note that during the process the root causes of the biggest environmental burden were in focus; the aim was to define a comprehensive picture that can be used to monitor the changes year after year.

Most of the environmental burden of the cash supply chain is related to supply chain operators (mainly cash logistics transport companies), with fuel use as the main source of the carbon footprint. Within the cash supply chain, in the case of cash production and the MNB's internal logistics, CO_2 emissions are caused mainly by the energy consumption of buildings and the machinery and equipment needed for production and processing.

Table 4
Cash supply chain carbon footprint*

Period	Carbon footprint (t CO_2e)	Change versus 2018 (tonnes)	Change versus 2018 (%)
2018	21,204	-	-
2019	19,522	-1,682	-7.9
2020	18,273	-2,931	-13.8
2021	21,078	-126	-0.6
2022	16,892	-4,312	-20.3
2023**	13,546	-7,658	-36.1

** The data are calculated from the raw data received from cash supply chain operators.*
*** Preliminary data*

The analysis shows that the main factors contributing to the recent improvement in environmental performance are:

- MNB subsidiaries involved in cash production organize their processes based on strict environmental management system requirements.

- The internal cash logistics activities of Hungarian Mint Ltd. (manufacturing coins for circulation) and the MNB are carried out within a single facility (the MNB Logistics Centre), where 100% of the electricity used comes from renewable sources since 2022; this significantly reduced its carbon footprint compared to previous years.

- Among the actors in the cash supply chain, the vehicle fleet of the transport companies carrying out activities with the highest environmental burden is constantly being modernized.

In the future, the most obvious way to reduce the carbon footprint of cash transportation may be to reduce the number of journeys made by cash-in-transit vehicles and renew the vehicle fleet. This can be achieved without jeopardising the security of cash supply, mainly by encouraging the recycling of banknotes and coins at the local (bank branch) level. This would eliminate the need to transport fit banknotes flowing into the branches for processing and then – to meet demand - returning it. The number of dedicated machines (typically ATMs with banknote recycling capability) has soared in recent years, but they only account for around 21 per cent of the total ATM network still, leaving significant room for further growth in the future.

Annex

METRICS USED IN THE ANALYSIS – METHODOLOGY AND LIMITATIONS

Emission indicators

While consistency is a primary consideration in the analysis, there may be differences in the range and the calculation of the emission metrics disclosed for different asset categories due to methodological specificities and the available data sets. Methodological differences make it difficult to compare the results of portfolio evaluations and do not allow for the calculation of a carbon emission or carbon intensity metric aggregated at the balance sheet level.

a) Sovereign portfolios

The central banks of the euro area published their first harmonized climate-related financial reports in 2023. Disclosures were prepared on the basis of a consistent framework following TCFD and PCAF recommendations. In the common framework, central banks use a uniform methodology to measure and publish the weighted average carbon intensity (WACI) and the total carbon emissions and carbon footprint for their euro-denominated portfolios managed by them for non-monetary policy purposes. Individual central banks may publish analyses with a broader coverage and different indicators; for example, the ECB has published an analysis covering corporate bond holdings purchased for monetary policy purposes in addition to non-monetary policy portfolios.

MNB has made several amendments to the previously used analysis methodology for sovereign assets in order to bring it closer to the practice used by eurozone central banks for a greater degree of comparability. In addition to WACI – as the main transition risk indicator- , the total carbon emissions and the carbon footprint of sovereign portfolios were also calculated, using both the production and consumption approaches. The production approach is based on the GHGs produced in a country at the time of calculating the indicators. This approach corresponds to the approach followed by the UNFCCC in preparing national emission inventories. The consumption-based approach corrects emissions data for the effects of foreign trade, capturing the GHG emissions generated by a country's consumption.

b) Corporate portfolios

When estimating the carbon intensity of the FGS and BGS portfolios, sectoral averages were used due to the lack of company-specific data, which may distort the results of the analysis. For the sectoral classification, the MNB used NACE categories, within which, for the BGS, more detailed industry carbon intensity data are also used, weighted by the shares within the portfolio. The main drawback of this approach is that the most carbon-intensive sectors may also include companies that are trying to achieve carbon neutrality through new, innovative technologies, while sectors classified as non-carbon intensive may also include companies with particularly high carbon intensity (e.g., an issuer's green bonds may have the same sectoral classification as its traditional bonds even though the amount of carbon emission is significantly different). This is also the case for the biased classification of companies producing green energy. Taking all this into account, and keeping in mind robustness, international best practice and comparability, reclassifications and corrections were applied in the calculations to tackle any distortions with material effects.

Table 5 Sovereign asset portfolios (FX reserves, government securities purchase programme)	
Weighted Average Carbon Intensity (WACI)	
Description	This is an indicator measuring a portfolio's exposure to carbon-intensive entities. It is the GHG intensity per PPP-adjusted GDP (production approach) or per population (consumption approach) of the emitting country multiplied by the share of exposure in the portfolio. Unit of measure: tonnes of CO_2e/EUR millions of GDP or tonnes of CO_2e per capita.
Formula	$WACI = \sum_i \frac{market\ value\ of\ exposure_i}{market\ value\ of\ portfolio} * \frac{GHG\ emission\ of\ the\ country_i}{PPP-adjusted\ GDP\ or\ GDP\ (at\ 2019\ prices)\ or\ population_i}$
Data source	GHG: MSCI (2021), GDP: World Bank
Total Carbon Emissions (TCE)	
Description	Indicator of the total GHG emissions financed by the portfolio. Unit of measure: tonnes of CO_2e.
Formula	$TCE = \sum_i \frac{market\ value\ of\ exposure_i}{PPP\ adjusted\ GDP_i} * GHG\ emission\ of\ the\ country_i$
Data source	GHG: MSCI (2021), GDP: World Bank
Carbon Footprint (CF)	
Description	It projects the total GHG emissions of the portfolio to the size of the portfolio. Unit of measure: tonnes of CO_2e/EUR millions of GDP
Formula	$CF = \frac{\sum_i \frac{market\ value\ of\ exposure_i}{PPP\ adjusted\ GDP_i} * GHG\ emission\ of\ the\ country_i}{market\ value\ of\ portfolio}$
Data source	GHG: MSCI (2021), GDP: World Bank
Corporate asset portfolios (BGS, FGS)	
Weighted Average Carbon Intensity (WACI)	
Description	A metric quantifying the GHG emissions of the assets in the portfolio arising in the production of a unit of value added Unit of measure: tonnes of CO_2e/EUR millions of value added
Formula	$WACI = \sum_i \frac{nominal\ value\ of\ investment_i}{market/collateral\ value\ of\ portfolio} * GHG\ intensity\ of\ sector_i$
Data source	Eurostat (Air Emissions Intensities, 2022)

Note: In the TCFD recommendations for the corporate sector, turnover data are used in the calculations, but in the MNB's TCFD report, due to gaps in individual data, the corporate WACI metrics are calculated using value-added based sector GHG intensity data instead of turnover.

In the production-approach, the WACI for the reserve portfolios was calculated using data aligned with the National Greenhouse Gas Inventory data available from external data providers (GHG Inventory, UNFCCC), which quantifies the amount of GHG emissions produced in a country's territory in accordance with international guidelines, for the seven main GHGs, expressed in carbon dioxide equivalents (CO_2e).

Brown share

The analysis of brown (carbon-related) corporate exposures is important for investors because the transition to a carbon neutral economic structure will be most challenging for companies with high carbon intensity, both from a technological and regulatory perspective. To identify carbon-intensive industries, the TCFD Working Group recommends using the Global Industry Classification Standard (GICS) sector classification. According to the TCFD's assessment, the energy and utilities industries (excluding water utilities and renewable energy companies) are the most carbon-intensive sectors and therefore the financial exposure to companies operating in these sectors should be assessed. The MNB used the NACE Rev. 2 sector classification instead of the GICS classification, within which the GICS carbon-intensive sectors can be matched with a

high degree of overlap. It is a disadvantage of the metric that it does not assess exposure based on the carbon intensity of individual issuers, but rather on sector classification, thus providing an indirect picture of brown assets.

Energy mix

A substantial shift in the world's energy mix from burning fossil fuels to using renewable energy sources is needed to meet the Paris Climate Accords. One way of measuring the risks arising from this transition could be to study the energy composition of the countries issuing securities. The energy mix is a good starting point for examining the transition risks arising from the structural characteristics of the energy supply, but it does not provide information on the level of energy supply, the capacity required for transition and the strategic plans and measures of the country to address climate risk.

Climate Action Tracker (CAT)[25]

For a forward-looking assessment of the transition risks of sovereign portfolios, the Climate Action Tracker data can be used to map out future potential emission pathways based on the GHG reduction commitments of countries, as measured against the Paris Agreement targets. For the calculation of reserve-level ratios, weights were determined according to the ratios of the sovereign exposures included in the foreign exchange reserves.

Bloomberg Government Climate Risk Scores

Bloomberg assesses the relative climate change transition risks of each country versus other countries in 3 dimensions. On a scale of 0 to 10, 10 is the best score.

- *Carbon Transition Score: assesses a country's past, present and prospective GHG emissions.*
- *Power Sector Transition Score: assesses a country's progress and future efforts to decarbonize its energy sector, taking into account the current share of fossil fuel and renewable generation and the level of clean energy investments.*
- *Climate Policy Score: evaluates a country's progress in achieving net zero goals and in developing frameworks related to green debt issuance and renewable energy policy.*

MSCI Sovereign CVAR[26]

The MSCI Sovereign CVAR examines the financial impact of NGFS scenarios, which assume different changes in yields and monetary policy responses to climate change. A methodological assumption is that the market immediately reprices individual financial instruments today in a way that reflects future interest rates in a given climate scenario.

- *Orderly 1.5°C ("Net Zero 2050"): In this scenario, global warming is limited to 1.5°C through stringent and immediate climate policies. The result is higher carbon and energy prices, leading to increased inflation. Generally, the short end of the yield curve is going up more because of short rates increasing in the near term.*
- *Orderly 2°C ("Below 2 degrees"): Global warming is limited to 2 degrees through immediate and smooth policy action. Carbon prices increase much less compared to the Net Zero 2050 and Divergent Net Zero scenarios. Interest rates diverge less from the climate-agnostic baseline, resulting in smaller yield curve shocks (and the shock on the curve tends to be more parallel).*
- *Disorderly 1.5°C ("Divergent Net Zero"): Despite limiting global warming to 1.5°C, this scenario involves higher carbon prices due to divergent policies across sectors and a quicker, later phase-out of fossil fuels. The lack of policy coordination places a high burden on consumers. Interest rates generally increase compared to the baseline (after a short dip for some countries) and stay higher for longer. This tends to move the longer end of the yield curve up more.*

[25] Climate Action Tracker
[26] MSCI ESG Research - How Climate Transition Risk May Impact Sovereign Bond Yields

- *Disorderly 2°C ("Delayed transition"): The next years until 2030 witness a "fossil recovery," following the trajectory of the current policies scenario until 2030. Stronger policies are then needed to limit warming to 2°C, with varying levels of action across countries and regions. The disorderly transition leads to an increase in interest rates once the delayed transition starts. Generally, the shorter end of the curve is less impacted, but the longer end goes up more.*

- *3° ("NDC"): In this scenario, currently pledged unconditional Nationally Determined Contributions (NDCs) are fully implemented, reaching energy and emission targets in all countries. The carbon price rises mildly, resulting in a mild impact on the yield curve.*

- *3° ("Current policies"): Existing climate policies remain in place, but there is no strengthening of ambition level of these policies. We see smaller impacts, as only country productivity damages due to physical risks are included in the NGFS modelling (no transition risk is accounted for in that scenario).*

When using the methodology, it is important to remember that the potential losses associated with the interest rate risk of the bond portfolio are not the same as the macroeconomic costs to the economy as a whole under different scenarios. From a macroeconomic point of view, the effects of different climate scenarios on economic variables such as real GDP are probably more relevant than the changes in interest rates.

Implied Temperature Rise – ITR27

The indicator indicates how companies and investment portfolios are aligned with the goals of the Paris Climate Agreement. The key to understanding the ITR is the concept of the CO_2 emission budget (carbon budget), that is, how much the world can emit so that global warming does not exceed 1.5 or 2 °C by 2100; and its extension, i.e., how much a company can emit, taking into account its fair share of global decarbonisation.

The ITR is about extrapolating the global implied temperature rise over the 2100 horizon as if the entire economy had the same CO_2 emissions budget overshoot or undershoot as a given company or portfolio. The methodology does not take into account the costs associated with the transition to a low-CO_2 economy and the avoided emissions.

Physical risks

For the analysis of physical risks, the model of the external data provider (Moody's Analytics) takes into account the results of six risk categories: flood, heat stress, hurricanes and typhoons, sea level rise, drought (water stress), and risks from wildfires. Within the risk categories, a number of indicators are quantified that capture the change in the exposure of the entity (country or company) to physical risks over the forecast horizon. The scores for each risk category correspond to a percentile rank order, i.e., from 0 to 100, where 0 represents the lowest risk level and 100 the highest risk exposure. Accordingly, physical risk scores show the relative riskiness of entities within the universe of analysis. This methodology of physical risk analysis is suitable to draw attention to the riskiest areas and entities. However, the analysis is not suitable for comparing the results of different asset classes (different universes).

Avoided GHG emissions

- *In the case of the foreign exchange reserves, the reductions in GHG-emissions published in each issuer's impact reports were aggregated for the analysis. There are significant differences in the methodology of the reports published by issuers and the lack of transparency makes the analysis difficult; in some cases, therefore, direct consultation with the issuer or reliance on expert estimates was necessary.*

- *In the case of MBPP, the estimate was made by combining data on the mortgage bonds purchased, on mortgage loan disbursements and on the total estimated stock of residential properties in the National Building Energy Strategy.*

[27] MSCI ESG Research - Implied Temperature Rise Methodology

Energy savings are converted into emissions avoidance based on the Clim'Foot database and the emission factors of the Partnership for Carbon Accounting Financials (PCAF).

- *Information provided by mortgage banks in their impact reports was used for the GMBPP.*
- *Based on specific energy usage (energy classification), size and emission factors reported by the PCAF, the annual GHG emissions from the annual operation of the properties participating in the GHP were estimated. The methodology takes into account only the GHG emissions saved in the operation of buildings, no data are available on emissions from construction.*

THE MAGYAR NEMZETI BANK'S CLIMATE-RELATED FINANCIAL DISCLOSURE

April 2024

Print: Prospektus Kft.

H-8200 Veszprém, Tartu u. 6.

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