



Green Bond Issuance by Banking Sector in CEE Region

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ABSTRACT

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Moving away from fossil fuels and transformation towards net-zero economy is among the top priorities worldwide. There is already a plethora of undeniable scientific facts underlying the financial consequences of climate change. The main goal of the presented study was to highlight the importance of speeding up the green transition in the region of Central and Eastern Europe (CEE). The sizeable investments into energy sector, transportation, construction, or manufacturing are necessary in the CEE region to catch up with the counterparts in western Europe. Banking sector has a power to shape the money flow in the economy. Therefore, it is especially important to investigate the position of banking sector in financing green transition in the CEE region.

Green bonds are an important financial tool which can channel private capital towards green transition, climate adaptation, and mitigation efforts. Herein, the focus was put on the green bond issuances made by banking sector in the selected central and eastern European countries. The research imperative was to investigate the actual environmental impact of green bonds, and the effect of green bond issuances on the strengthening environmental commitments in banking sector. Nevertheless, the green bond market is established in the investigated CEE countries, the green bond issuances made by banking sector are still relatively new in this region. Thus, the evaluation of real environmental benefit arising from green bond financing is challenging. It was observed that mainly three green projects categories are being financed through green bonds as follows: green buildings, renewable energy, and clean transportation. Even though these sectors are relevant for green transition, there is only minor progress in decarbonization of hard to abate sectors.

Significant shift forward in communication of environmental targets was observed in banking sector over the past recent years. This is more likely to be a result of multiple drivers not just green bond issuance itself. The orchestrated interplay of strengthening regulations, investor's demand for improved transparency of green products and services, or competitive advantage are challenging companies to set ambitious climate goals.

Key words: green bond, environment, impact, climate change, CEE region

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ABBREVIATIONS AND TERMS

CE	Circular Economy
CEE	Central and Eastern Europe
CSRD	Corporate Sustainability Reporting Directive
DNSH	Do No Significant Harm
ESG	Environmental, Social, Governance
ESMA	European Securities and Markets Authority
EU	European Union
GAR	Green Asset Ratio
GB	Green Bond
GBP	Green Bond Principles
GHG	Greenhouse Gas
ICMA	International Capital Market Organization
MSS	Minimum Social Safeguards
SDGs	Sustainable Development Goals
tCO ₂	Tons of carbon dioxide equivalent

1 INTRODUCTION

Climate change has reached its tipping point. If the business as usual continues, the least optimistic scenarios predict the rising temperatures 3.5 – 4°C by the end of the century when comparing to the pre-industrial era. The consequences are far more serious than “just” warmer climate. Increasing global temperatures are accompanied by disrupting events such as rising sea level, water scarcity, intensive droughts, wildfires, flooding or decline in biodiversity. These represent threat for human health, food security or housing. In case of no action, businesses will be facing severe climate-related risks as well. Physical risks associated with changing weather patterns can discontinue company operations, supply chain or availability of resources. Transition risk is arising from the shift to net-zero economy at the global level. Moreover, companies can be exposed to legal risk if the non-financial reporting requirements are underestimated. Repercussions can vary from reputational damage to financial loss or legal sanctions. Thus, with the increasing awareness, it is starting to be widely accepted that greening the economy is inevitable.

Transformation of traditional linear economy business model into green economy requires precise coordination of technological advances, financial instruments, and policies. Especially, private investments can create enabling conditions for phasing out harmful environmental activities, stimulate and facilitate innovations. Expansion of green economy can be supported by concrete actions such as introduction of renewable energies, implementation of sustainable solutions into housing and construction, agricultural practices, restoration of ecosystems and biodiversity conservation. Decarbonization of hard to abate sectors is the most challenging. Transition plans for moving out from fossil fuels are crucial to limit global warming below 1.5°C.

The banking sector plays a pivotal role in the transition towards sustainable living. Financial institutions are major players and possess real power to drive green transition. Acceleration of private investments and re-direction of the money flow towards green economic activities is substantial responsibility of banking sector.

Perception of green economy should be in the bigger picture where environmental benefits cohabit with business opportunity. Climate change re-shapes the way how the business has been done for decades.

Green bond is financial instrument gaining an increasing attention as a tool for raising capital to address climate change mitigation and adaptation. Investors interested in green bonds can be characterized by environmental preferences, motivation to green their portfolios and mitigate climate-related risks. Nowadays, the widely accepted definition of green investment is the use of proceeds towards eligible green projects as defined by International Capital Market Association (ICMA). Transparent green investment needs to fulfil voluntary ICMA principles including the reporting of achieved impact. Herein, the impact metrics for green projects are defined as well, however these are more in the form of minimal requirements than complex impact indicators. When investigating green bonds, the financial perspective is prevalent while real environmental outcomes may be hindered. Thus, to ensure that green bonds are meeting their true potential, the more in-depth investigation is necessary.

1.1 Goals and Objectives

Financing and mobilization of private capital is an integral part of transformation towards green economy. The focus of the existing research is usually put on the financial perspective of green bonds. Therefore, the primary goal of the thesis was to discuss green bonds from the perspective of environmental impact. The overarching question was: “Are the green bonds really green?”.

The research has been centered around the green bond market in the region of Central and Eastern Europe (CEE). The CEE region has been selected from two main reasons: a) there is an urgent need to speed up green transition which takes off slower in comparison to western Europe, b) expanding and uncovered potential of green bond market in the CEE region. Green bond issuances have been evaluated from the position of banking sector considered to be a main driver of

green transition. The investigation aimed to consult the mechanisms for evaluation of green bond transparency. Main pillars of the investigation can be presented as follows:

- Summarization of the green bond issuances made by banking sector in the CEE region,
- evaluation of the green bond environmental impact based on publicly available materials and information,
- discussion of climate targets set by banks with no green bond issuance and by banks with the first green bond already issued.

As the research sample, ten CEE countries have been selected for investigation as follows: Poland, Hungary, Czech Republic, Slovakia, Slovenia, Romania, Serbia, Estonia, Latvia, Lithuania. For each country, 5 largest banks according to their assets have been analyzed. The research approach combines quantitative and qualitative data collected from open and publicly available data sources, and websites of selected banks. At this moment, the vast majority of green bond issuers follow voluntary guidelines and principles, thus the granularity of disclosed data is often limited which makes the evaluation of real environmental impact very challenging.

1.2 Thesis Structure

The structure of the thesis consists of introduction, literature background, methodology, results, discussion, and conclusions section. Introduction sets the scene and explains the main thinking points for the investigation. Literature background states the current level of knowledge in the researched area - provides an overview of green bonds as financial instrument and explains the position of banking sector in decarbonization of the economy. Methodology section describes the approach applied to answer the research questions. Results section presents the main findings which are debated in discussion. Conclusions aim to briefly summarize the pivotal observations of the research and formulate recommendations for future investigation.

2 THEORETICAL BACKGROUND

2.1 Debt Instrument - Bond

Bond is a type of debt security – debt instrument that pools the shareholders' money and these are invested into variety of securities. Typically, bonds have defined basic terms such as the amount borrowed by investor, interest rate, maturity, and renewal date (Fernando, 2023). Bonds are bought by investors to earn an interest. Principally, an investor buying bond is lending money to bond issuer in exchange for interest payments until the bond maturity. When bond reaches its maturity, the bond issuer returns the money to investor (lender) (Jark, 2023).

Bond or debt market is the financial market where buyers and sellers exchange bonds. The primary and secondary markets are known where the bonds, stocks and other securities are traded (FIGURE 1). Basically, the securities are created at the primary market where the companies are selling the bonds to the public for the first time. For instance, Initial Public Offering (IPO) is a typical primary market transaction. Issuing company indicates the issue price, and investors can buy directly from issuer. On the other side, the issuing company is not directly involved in the secondary market. Herein, securities bought from the primary market are traded among investors (Beers, 2021).

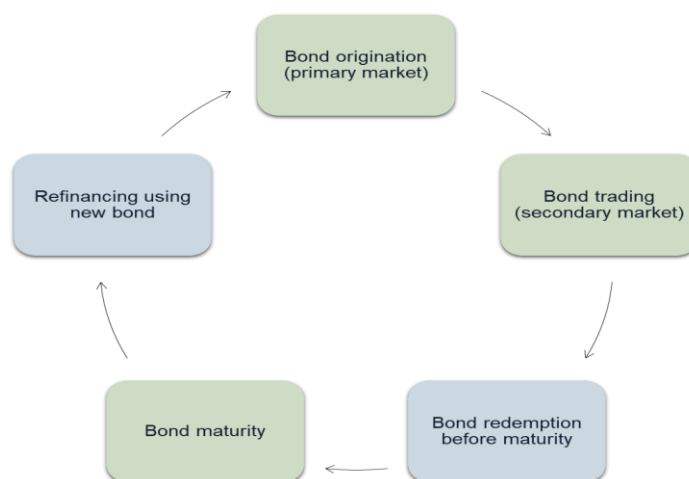


FIGURE 1. Bond life cycle. Green boxes represent usual life cycle and blue boxes represent optional steps in green bond cycle.

Several types of bonds can be issued (FIGURE 2):

- **CORPORATE BONDS** – corporates issue bonds to collect capital for funding new projects or business operations.
- **GOVERNMENT BONDS** – governments issue bonds to finance government spending or expenditure such as employees' salaries or infrastructure project. Generally, government bonds possess less risk than corporate bonds, thus corporate bonds tend to provide better returns.
- **MUNICIPAL BONDS** – are issued by states, cities, or counties to finance public projects or operations.
- **MORTGAGE-BACKED BONDS** – offer protection to the investors since they are secured by an asset, real estate holding or real property. In case of a default situation, bondholders have compensation in the underlying property which might be sold. Generally, these bonds are considered safer than corporate bonds, thus have a lower return rate.
- **EMERGING MARKET BONDS** – are issued by countries with developing economies. On the one side, emerging market bonds can provide an opportunity for higher return and portfolio diversity, however on the other side, higher risk is associated due to the potential political and economic volatility of developing countries (Chen, 2020; Chen, 2021; Segal, 2022; Jark, 2023).

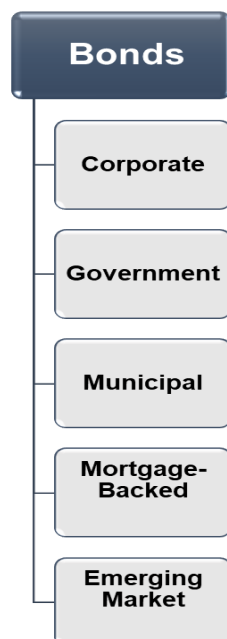


FIGURE 2. Types of bonds according to their issuer.

2.1.1 Green Bonds

The concept of green bond is in principle the same as conventional bond. However, the purpose of green bond is to finance/re-finance the projects bringing the environmental benefits. In practice, the proceeds raised from bond issuance, in other words the money collected from investors, are used to support the projects positively contributing to environment, and climate (Corporate Finance Institute, n.d.). Green bond with positive environmental impact finances for instance renewable energy, green buildings, circular economy solutions or waste and water management technologies. The impact of green bond is frequently expressed as reduced CO₂ emissions, pollution prevention, biodiversity preservation and restoration, diversion from fossil fuels (Tang and Zhang, 2020).

The green bond market was established in 2007, when the European Investment Bank issued the inaugural Climate Awareness Bond. The capital raised from the bond issuance was used to finance renewable energy and energy efficiency projects (Sertore, 2022). One year later in 2008, the World Bank issued the green bond supporting exclusively climate-related projects. Over the years, the success of green bonds inspired the issuance of other types of bonds labelled as social or sustainability bonds. While social bonds are oriented on socially responsible projects such as support of education, healthcare or employment generation and protection, sustainability bonds represent the combination of social and green. It means that capital raised from issuance of green bonds can be used solely to finance or re-finance environmentally beneficial projects. Capital raised from the issuance of social bonds can be used to support purely socially responsible projects. In the case of sustainability bonds, combination of green and social projects can be supported. Nowadays, there are multiple variations of green thematic bonds, for instance blue bonds where capital is used to finance water/ocean protection. By far the most popular among investors and bond issuers as well are still green bonds (Tang and Zhang, 2020; Sertore, 2022).

Following the first green bond issuance in 2007, the green bond market was rapidly growing and gained its momentum in 2021. The decline was observed in

2022, however the prediction of accelerating green bonds issuance in 2023 appears to be true according to the latest analysis by Linklaters based on Bloomberg data. In the first half of 2023, the total revenue from green bonds reached USD 351bn. The green bonds are still holding a leading position in sustainable bond market, representing about 53% of all sustainable bonds issued in 2023 worldwide. Out of the 1758 sustainable bonds issued, 935 was represented by green bonds. Almost half of green bonds was issued in Europe which confirms the Europe position as the largest green bond issuer (Macknight, 2023).

2.1.2 Transparency of Green Bonds

Initially, the motivation behind green bonds was more about competitive investment opportunity, however the real impact was not widely questioned. Since the rising popularity of green bonds, the investors have gradually started demanding the assurance that their money has been put into projects with positive and measurable environmental impact. Also, the investors awareness in climate-related topics is increasing, thus their demands are getting more sophisticated. Nowadays, the investors are often interested to see the actual data showing how the environmental, social and governance factors are covered by green bonds (The World Bank, 2019).

Now, the pre-issuance and post-issuance guidelines for green bonds are on the voluntary basis. The Green Bond Principles (GBP) issued by International Capital Market Organization (ICMA) are widely accepted as market standard. The green bond alignment with the ICMA principles is considered a proof of green bond transparency and trustworthiness. The GBP define 4 core elements of green bonds:

- use of proceeds,
- process for project evaluation and selection,
- management of proceeds,
- reporting.

The existence of green bond framework and external review process are a prerequisite of transparent green bond. The Green Bond Principles explicitly define

the eligible green projects which might be financed or re-financed with the capital raised from green bond issuance:

- green buildings,
- renewable energy,
- energy efficiency,
- pollution prevention and control,
- environmentally sustainable management or living natural resources and land use,
- terrestrial and aquatic biodiversity,
- clean transportation,
- sustainable water and wastewater management,
- climate change adaptation
- circular economy adapted products, production technologies and processes (International Capital Market Organization, 2021).

As mentioned above, one of the core components of green bond according to the ICMA principles is the impact reporting. The green bond issuer is expected to publish a report showing the allocation of proceeds raised from bond issuance, and the environmental impact of financed projects. The report should be published starting the one year after the green bond issuance until the full allocation. Usually, the allocation part of green bond report shows the breakdown of financed and/or re-financed projects based on the eligible green categories or geography (International Capital Market Organization, 2021). The impact part should be showing the actual environmental benefits resulting from the financed projects. Harmonised Framework for Impact Reporting defines sector specific guidance and reporting metrics.

The examples of core indicators for eligible green categories as defined in Harmonised Framework for Impact Reporting are as follows:

Green buildings:

- GHG emissions reduced/avoided in tCO₂e (tons of carbon dioxide equivalent),
- energy performance level/local certification level.

Renewable energy and Energy efficiency projects:

- annual GHG emissions saved/avoided in tCO_{2e} (tons of carbon dioxide equivalent),
- annual renewable energy generated in MWh/GWh for electricity or in GJ/TJ for other energy sources.

Sustainable water and wastewater management:

- annual absolute (gross) water use before and after the project realization in m³/a, reduction in water use in %.

Waste management and resource efficiency:

- waste prevented, minimised, reused or recycled before and after the project in % of total waste and/or in absolute amount in tonnes p.a. (population equivalent).

Clean transportation:

- passenger-kilometres (the transport of one passenger over one kilometre),
- annual GHG emissions reduced/avoided in tCO_{2e},
- reduction of air pollutants: particulate matter (PM), sulphur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), and non-methane volatile organic compounds (NMVOCs).

Biodiversity:

- maintenance/safeguarding/increase of protected area/OECM/habitat in km² and in % for increase,
- absolute number of predefined target organisms and species per km² or m² before and after the project.

Circular economy and eco-efficient projects:

- the % increase in materials, components and products that are reusable, recyclable, and/or certified compostable as a result of the project.

Climate change adaptation:

- increase in grid resilience, energy generation, transmission/distribution and storage in MWh,
- reduction in the number of wildfires, and/or in the area damaged by wildfires in km².

Living natural resources and Land use projects:

- water savings from improved irrigation, stormwater and rainwater capture, groundwater recharge and/ or the reuse of highly treated wastewater (e.g. m³/year),
- increase in area under certified organic or sustainable agriculture (ha and % of acreage farmed) (International Capital Market Association, 2023).

Green bonds represent an essential tool for financing towards carbon-neutral and resource efficient economy. It is essential to ensure that issued green bonds are transparent and bringing real environmental benefit. If the true potential of green bonds is fulfilled, then green bonds can play a major role in speeding up the green transition. Moreover, financing of environmentally responsible projects through green bonds can contribute to transformation of traditional into sustainable business model. Green investments can help companies to set and achieve net-zero targets. Finally, the goal which green bonds can contribute to is the adaptation and mitigation of climate change.

2.1.3 Climate Change in Business Context

The terms climate change and global warming are often used interchangeably. Climate change is characterized as the long-term shifts in temperatures and weather patterns. Climate change encompasses global warming, but also covers the diverse spectrum of changes that our planet is experiencing. It is, partially, natural process resulting from volcanic activity or sun's activity. However, since the industrial revolution in 1800s, human-related activities are the main driver of climate change. Burning of fossil fuels such as coal, oil and gas generates a huge amount of greenhouse gas emissions (United Nations, n.d.; NASA, n.d.).

Greenhouse gases (GHG) are trapping heat in the atmosphere and causing so-called "greenhouse effect" which leads to the global warming. The most abundant greenhouse gas released into the atmosphere because of human activity is carbon dioxide (CO₂). Particularly burning of fossil fuels for energy, transportation, construction or for industrial purposes is the main source of CO₂. Another GHG of concern is methane (CH₄) mostly emitted from agriculture, industry, or landfills.

The following GHGs are emitted as well: nitrous oxide (N₂O), fluorinated gases (HFCs, PFCs, NF₃, SF₆) (Environmental Protection Agency, n.d.).

Traditional linear economy business model is the main driver of climate change. The linear economy is based on the extraction of primary materials, production, consumption, and disposal. For decades, businesses supported the overconsumption and single use products. However, the way how the business is conducted is changing nowadays. There is a global effort to transform linear into circular business model (Bocken and Short, 2021; Almeida Neves and Cardoso Marques, 2022). Circular economy (CE) can be understood as the economy model based on the efficient use of resources. The CE model minimises waste generation, reduces the use of primary resources, aims to generate long-term value, and strives for closed loops in production (Morseletto, 2020). Firstly, circular economy was based on the 3Rs – reduce, reuse, recycle (Manickam and Duraisamy, 2018). Then, the 6Rs concept was introduced – reuse, reduce, recycle, redesign, refurbish, repurpose (Reike et al., 2018). Morseletto (2020) developed this concept even further, the 10Rs was introduced – refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, recovery. The principles of sustainability must be holistically integrated into the business to ensure the success of transition from linear into circular business model (Bocken and Short, 2021).

Climate change and global warming are still accompanied by doubts and these topics are often trivialized. However, a plethora of studies conducted over the last decades is providing strong evidence of changing climate due to the anthropogenic activities. It can be concluded with high confidence that mean global temperature is increasing. Diverse measurements have been applied to analyse the heat-trapping gases or so-called greenhouse gases in the atmosphere, land, and sea (USGCRP, 2017). Human-driven activities such as deforestation, change in land use and most importantly burning of fossil fuels are mainly responsible for dramatic increase of the atmospheric CO₂ in comparison to the pre-industrial levels (Friedlingstein et al., 2019). In numbers, the concentration of CO₂ in atmosphere increased from approximately 277 ppm (parts per million) in 1750 (Joos and Spahni, 2008) which is the beginning of industrial era to about 418 ppm in

October 2023 (Global Monitoring Laboratory, 2024). From 1950, the CO₂ emissions have become dominant. In conjunction with other factors such as deforestation and change in land use, forests, vegetation, and ocean have run out of capacity to uptake all produced CO₂, thus billions metric tons of CO₂ remain in the atmosphere each year (Friedlingstein et al., 2019).

The scientific evidence shows that climate change and warming of the planet are indisputable. The action must be taken at level of governance, public and private sector. In opposition to solving climate problems are standing in many cases businesses based on the use of coal and fossil fuels. They feel pressured by increasing demands coming from regulators to change the way how they are doing business which requires huge investments. Dismissive attitude frequently comes from the fact that businesses are not aware of risks associated with climate change and with opportunities arising from the business transformation as well. Helping the planet must not be charitable and loss-making activity, on the contrary, sustainable business and consideration of environmental-social-governance (ESG) factors is predicted to become “next big thing”. Thus, businesses should sharpen their focus on sustainability.

2.2 The Concept of ESG and Green Transition

Incorporation of sustainability principles into business is increasingly expected from the company stakeholders such as customers, investors, employees, suppliers or public in general. Transformation towards sustainable business is not only about climate change but encompass a multi-dimensional process requiring integration of environmental, social, and governance (ESG) factors into corporate decisions. The term ESG fully replaced previously used “corporate social responsibility” and is firmly anchored in corporate decision-making process. Sustainability as an emerging megatrend can represent key success factor but also a challenge at the multiple levels. Sustainable transformation is never achieved by single action, however, requires systemic approach in the long-term horizon (Müller and Pfleger, 2014).

For business, to benefit from sustainable transformation, sustainability must be incorporated into core business such as business strategy, business model, processes, products, and services (Schaltegger and Müller, 2008). Baumgartner and Ebner (2010) defined 4 sustainability strategies characteristic for businesses:

1. Introverted – focusing mainly on risk mitigation and fulfilling legal obligations.
2. Extroverted – focusing on external relationships.
3. Conservative - focusing on eco-efficiency.
4. Visionary – complex approach considering sustainability aspects within all business activities.

ESG factors (FIGURE 3) are often considered to be a driver of green transition. The concept of green transition aims to achieve environmental and economic equilibrium. Current overconsumption of natural resources is unsustainable. Green transition represents shift from the way how business traditionally happens towards sustainable economic growth without further depletion of natural resources. Thus, green transition needs to be part of sustainable strategy in each sector focusing on the phasing out fossil fuels use on the one side and implementing circular economy principles and use of renewable resources on the other side (Ministry of the Environment, Finland, n.d.).

Initially, the ESG concept was rather unknown, and not many companies were interested to incorporate the ESG factors into their business. However, the increasing environmental and social awareness, and the strong push from regulators are transforming ESG from voluntary into mandatory. Underestimation of ESG factors and failing to incorporate regulatory requirements can company affect on multiple levels resulting into financial loss (Ellis, 2023). Moreover, late, and inadequate response to climate change can negatively affect not just financial performance of companies at the individual level, but also economy, cause financial loss or reduction of job opportunities (Braga and Ernst, 2023).

The idea behind the ESG shortcut was established in the 1960s and is associated with the publication of the book “Silent Spring”. The book can be considered

groundbreaking since it addressed the harm caused by uncontrolled use of pesticides on environment, brought into attention the disinformation spreaded by chemical industry, passivity of public and its willingness to accept marketings claims without hesitation, and further questions (Carson R, 1962). The book had a nationwide impact and resulted in the ban of DDT use for agricultural purposes.

In 1987, the World Commission on Environment and Development of the United Nations introduced the term *sustainable development* and provided its definition: “*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*”. Five years later, in 1992, the role of the financial sector in incorporation of environmental and social criteria into all aspects of business was recognized. This originated from the issuance of the Statement of Commitment by Financial Institutions on Sustainable Development by the United Nations Environment Program (UNEP).

The balance of environmental, social, and economic goals was based on the concept of sustainability framework “Triple Bottom Line” introduced by John Elkington in 1994. This concept is based on the 3 P’s: profit, people, planet. The main goal is to combine positive environmental and social impact with thriving business (Miller, 2020).

In 2004, the joint initiative of financial institutions and the United Nations Secretary General Kofi Annan resulted in the publications of “Who Cares Wins” report. This significant milestone first introduced the term ESG. The focus of the report was the material impact of environmental and social issues on investment value (The United Nations Global Compact, 2004; CarbonView, 2021).

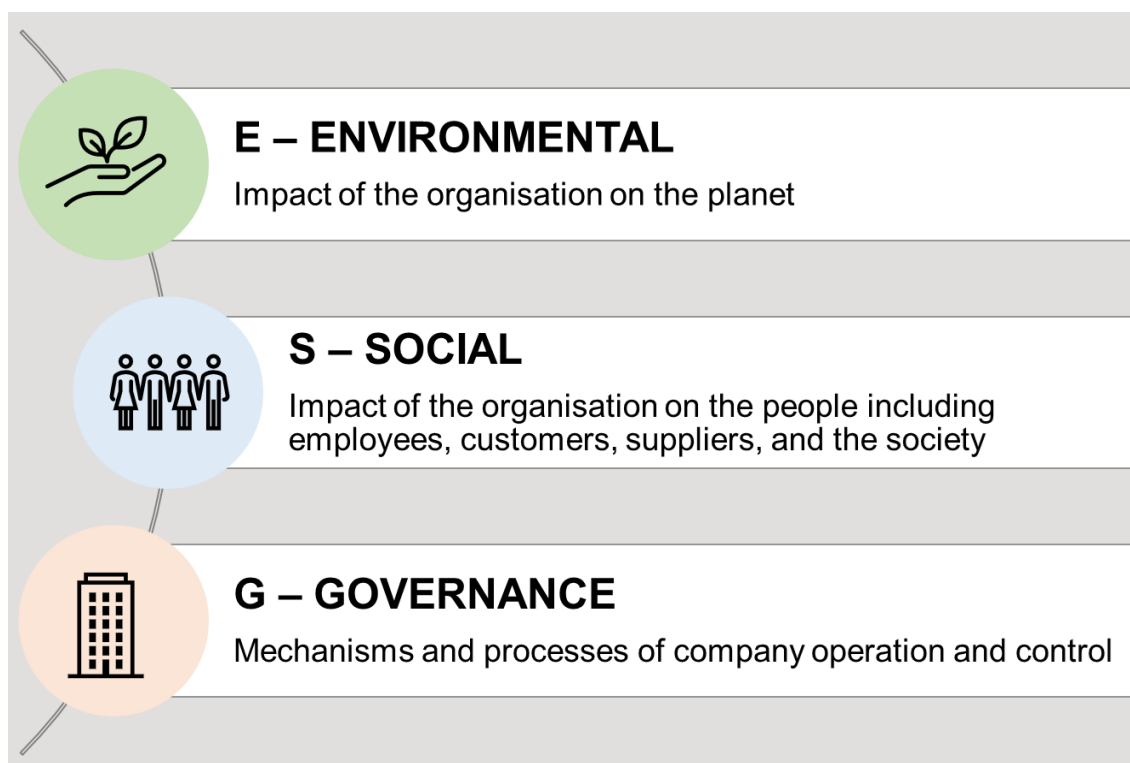


FIGURE 3. Three pillars of ESG – Environmental, Social and Governance concept.

Climate commitments and goals of the green transition are supported by initiatives and agreements worldwide. In 2015, The Sustainable Development Goals (SDGs) were adapted as part of the 2030 Agenda for Sustainable Development. The 17 SDGs represent a call to action targeting end of poverty, planet protection and bring prospects to people. In 2016, the Paris Agreement entered into force and 194 Parties have joined the Agreement by now. The Agreement has set long-term climate goals and requires commitments from all member states. The Paris Agreement plays an essential role in the achievement of Sustainable Development Goals. There are 3 main goals defined in the Paris agreement:

- Reduction of greenhouse gas emissions (GHG) and keeping the global temperature increase well below 2 °C while striving to even more ambitious goal 1.5 °C.
- Committed countries are required to submit updated climate action plan every 5 years.
- Aim is to provide financial support to developing countries to mitigate climate change (United Nations, n.d.).

Later in March 2020, The European Green Deal represents the first public commitment to achieve net-zero emissions and make Europe the first climate-neutral continent by 2050. Simply put, the amount of GHG emissions produced and removed from the atmosphere will be in balance. The legislative package “Fit for 55” was adopted as part of the EU Green Deal. New policy measures strive to meet the climate-neutrality targets, thus the goal to cut greenhouse gas emissions of at least 55% by 2030 in comparison to 1990s levels was set (Almeida et al., 2023). The EU Green Deal strategy aims to overcome the challenges associated with climate change and degradation of the environment. Climate challenges need to be understood as business opportunities driving green transition. Coherent set of policies and reforms will be required by all EU member states. The term “just transition” encompasses the concept of green transition which will fit to individual requirements of each EU member state (European Commission, n.d.).

More than 70 countries including biggest carbon emitters such as China, the United States and the European Union have the targets set to achieve net-zero emissions by 2050. However, the recent observations are rather skeptical in the way that the commitments are not bringing expected results. Looking at the national climate plans, global GHG emissions would rise by 11% if the efforts are not strengthened. Failing to fulfill voluntary climate goals triggers stricter regulations at the global and national levels.

2.3 The Position of Banking Sector in Green Transition

Banking sector has irreplaceable position in financing sustainable business transformation and decarbonization of global economy (Rahman et al. 2023). Main philosophy of the sustainable finance concept is to consider ESG factors when making investment decisions. Green finance can be defined as a subset of sustainable finance, it means financing the projects contributing to the achievement of one or more environmental objectives including climate change mitigation and climate change adaptation (Brühl, 2022). Green bonds are one of the most promising sustainable finance instruments to channel funds into projects bringing environmental benefit (Fatica et al., 2021).

Companies publicly declaring positive mindset towards environmental and ethical practices tend to have higher ESG score and are less prone to reputational damage. Thus, investing into companies with environmentally and socially responsible business model is the important pillar of sustainable finance (Kreivi, 2023; European Commission, n.d.). Gradually, the term of sustainable banking is being introduced, however the definition is still not unified. Yip and Bocken (2018) defined sustainable banking as the *“delivery of financial products and services developed to meet the needs of people and safeguard the environment while generating profit”*.

It is imperative to mobilize sufficient financial resources to achieve net-zero emissions by 2050. On the one hand, it is of great importance that banks should incorporate sustainable practices in their own operations. On the other side, the most significant impact of banking sector lays in re-directing capital towards environmentally responsible projects, encouraging stakeholders to undertake responsible green investments, and developing new green finance products. Also, the carbon footprint of banking sector associated with the investing and lending activities is incomparably higher than GHG emissions resulting from the direct banking operations. There is also a need to establish a proactive regulatory network, the real impact of funded green projects should be under the increased scrutiny. Banking sector can establish interlink between economic growth and environmental protection (Rahman et al. 2023).

International Finance Corporation defined in the input paper for G20 Green Finance Study Group (2020) four indicators considered to be a key in tracking green banking:

1. Banking commitments – the adoption and implementation of green finance principles, standards, and practices by banks.
2. Financial flow – the volume and distribution of bank assets to green investments.
3. Financial risk – integration of environmental, social and governance factors and the impact on financial assets quality, for instance tracking of non-performing loans.

4. Environmental and social outcomes – achievement of positive impact in core financing activities while mitigating negative environmental/social impacts.

The pressing question is how to finance green transition without a negative impact on economy, living standard and job security. Diversion from fossil fuels and from business based on fossil fuels represent a challenge for hard to abate sectors such as agriculture, manufacturing, infrastructure, energy, or aviation. Technological developments are essential for successful transformation, however these require also human resources, when the nature of many jobs will be changed, the workers will need to acquire a new job skill (Aracil et al. 2021; Braga and Ernst, 2023). From this reason, the shift from traditional economic model to the green economy must be accompanied by complex changes, and all necessary aspects of the change need to be financed.

2.4 Sustainable Finance Legislation in European Union

Banking sector is pushed from both, ideological and regulatory perspective to transform towards sustainable business model (Riegler, 2023). Sustainable Finance Strategy developed by European Union has three overarching goals:

- Enhancing the transparency for investors,
- Avoiding and identification of greenwashing practices,
- Channelling more capital towards sustainable economic activities (Brühl, 2022).

In 2018, the European Commission adopted the Action Plan on Sustainable Finance. The regulatory framework in European Union consists of multiple inter-linked legislative components. Herein, the Taxonomy Regulation (TR), the Sustainable Finance Disclosure Regulation (SFDR) with the corresponding Regulatory Technical Standards, and the Corporate Sustainability Reporting Directive (CSRD) (Brühl, 2022). Legislative framework is significantly broadening the reporting requirements for “in scope” financial and non-financial corporates.

The EU Taxonomy represents a cornerstone and an essential transparency tool of the EU Sustainable Finance Framework. It is a science-based classification system defining criteria for economic activities aligned with a net-zero trajectory by 2050. The main goal of the EU Taxonomy is to provide unified definition of environmentally sustainable economic activities, thus provide a common basis for financial and non-financial companies (European Commission, n.d.). The EU Taxonomy defines six environmental objectives as follows:

1. Climate change mitigation,
2. Climate change adaptation,
3. Sustainable use and protection of water and marine resources,
4. Transition to a circular economy,
5. Pollution prevention and control,
6. Protection and restoration of biodiversity and ecosystems (EU Taxonomy Overview, n.d.).

The Taxonomy Regulation entered into force in July 2020, and was subsequently accompanied by several delegated acts. The Delegated Act on sustainable activities for climate change adaptation and mitigation objectives applies from January 2022. Beginning of January 2023 applies under the strict conditions Complementary Climate Delegated Act including nuclear and gas energy into the list of sustainable activities under the EU Taxonomy. The latest Environmental Delegated Act applies starting January 2024 and defines criteria for sustainable economic activities falling under the four environmental objectives – sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control, protection and restoration of biodiversity and ecosystems (European Commission, n.d.).

To classify economic activity as sustainable according to the EU Taxonomy, the four criteria must be fulfilled:

- The economic activity must significantly contribute to at least one out of the six environmental objectives.
- The economic activity must comply with the “do no significant harm” (DNSH) criteria which means that the activity needs to meet the

substantial contribution criteria for at least one environmental objective and at the same time cannot harm other environmental objectives.

- The minimum social safeguards (MSS) must be met, thus the economic activity must be in line with the UN Guiding Principles on Business and Human Rights. Environmental benefit cannot be associated with negative social impact, thus the effect of economic activity on society, own workers and workers in the supply chain must be properly evaluated.
- The economic activity must comply with the technical screening criteria as defined by the EU Technical Expert Group (EU Taxonomy info, n.d.).

When evaluating the economic activity in context of the EU Taxonomy, two terms need to be correctly understood – taxonomy eligibility vs taxonomy alignment. Taxonomy eligibility/eligible activity under the EU Taxonomy means that the specific economic activity has the technical screening criteria set out in the EU Taxonomy. However, taxonomy eligibility does not mean fulfilment of the specified criteria. Thus, all revenue, CAPEX and OPEX can be disclosed as taxonomy eligible. On the other hand, taxonomy alignment/activity aligned with the EU Taxonomy means that the specific economic activity is meeting all four criteria as defined in the EU Taxonomy. Thus, making substantial contribution to at least one environmental objective while not doing harm to other environmental objectives, meeting the MSS criteria a technical screening criterion. All revenue, CAPEX and OPEX can be disclosed as EU Taxonomy aligned (European Commission, n.d.).

Under the EU Taxonomy, the financial institutions are obliged to disclose starting:

- January 2022 - proportion of taxonomy eligible assets under the climate mitigation and climate adaptation objectives for the previous year.
- January 2023 – proportion of taxonomy eligible assets under the six environmental objectives.

- January 2024 - proportion of taxonomy aligned assets under the six environmental objectives.

Furthermore, starting from January 2024, European banks fall under the scope of Green asset ratio reporting responsibility. Key performance indicator – Green asset ratio (GAR) represents standardized and comparable measure which requires banks to disclose the percentage of assets invested into environmentally sustainable projects and activities (Dydon AI, 2023).

2.4.1 EU Green Bond Standard

Pressure to foster the green bond transparency, consistency, and comparability across the green bond market is increasing. Thus, the European commission proposed the new regulation European green bond standard in 2021. The main goal of the standard is to provide so called “gold standard” for green bonds issuers. Green bonds labelled by EU green bond standard would have to finance exclusively projects aligned with EU taxonomy. The new standard is expected to minimize the risk of greenwashing, thus it will encourage the investors’ confidence in green investments. In 2022, the provisional agreement was reached on EU green bond standard. So far, the usage of EU green bond standard is expected to be on the voluntary basis (Council of the European Union, 2023). However, with the current obstacles in evaluation of EU taxonomy alignment, there are doubts across green bond issuers if the issuance of green bond with EU green bond label is even realistic. This is especially true for the CEE region.

3 METHODOLOGY

The proposed research aimed to shed more light on the green bond market in Central Eastern Europe (CEE) region. There are two main reasons to investigate specifically CEE region: 1. Necessity to speed up green transition in the region, and 2. Expanding green bond market with huge potential, however the comprehensive research is missing. Banking sector is considered a major player in financing green transition through re-directing investments into environmentally sustainable projects. Therefore, the investigation is centred around banking sector as one of the most frequent green bond issuers.

Herein presented research is conceptualized as data-driven, based on the available quantitative and qualitative data. The main purpose of the presented research was to collect available data characterizing the green bond issuances in CEE region and analyse the significance of green bond market in this region. Up to this date, there is only limited literature available summarizing the specific emerging CEE green bond market. The research challenges were mainly represented by lack of consistent and comparable data. Since the green bond issuance and reporting of associated environmental impacts are based on voluntary standards, the granularity of available data is insufficient in most cases. Also, transparency of the disclosed data might be disputable especially in case of green bond impact reporting where usually final bank report is available, and the verification of the initial data is not possible. This is coming also from the nature of the banking sector where most of the data is confidential.

Despite of obstacles associated with data collection, the research summarized the main observations in terms of environmental impact of green bonds. Based on these the conclusions and recommendations have been postulated.

3.1 Research Questions and Goals

The focus of the study was put on the green bond market, hence green bonds are considered a powerful tool to finance green transition to a net-zero economy. There are two main perspectives, financial and impact, when analysing green

bonds. From financial perspective, there is money flowing in concept which can be explained as money earned by the green bond issuance either on the issuer side or financial profit from the interest payments on the investor side. From impact perspective, money flowing out concept was defined as money invested into specific green projects bringing environmental benefits. In addition to apparent financial motivation, there are also non-financial incentives associated with green bonds, both from the perspective of green bond issuer and investor. The fundamental non-financial goal is to generate positive environmental outcome. To use the full potential of green bonds as a financing instrument for green transition, it is essential to know the real environmental impact. When discussing green bonds, risks associated with climate change, and the regulatory pressure coming from policymakers is crucial area to consider.

Herein, the research has been narrowed down to further investigate the „money flowing out“ concept (FIGURE 4) and the effect of green bond issuance on issuers environmental commitments. The research questions were defined as follows:

MONEY FLOWING OUT - What is the real environmental impact of green bonds?

- Can the actual impact of green bonds be estimated?

ISSUERS PERSPECTIVE - How does the issuance of the first green bond affect issue commitments towards net-zero, sustainability strategy and business model?

- Can the issuance of first green bond strengthen the issuers environmental responsibility, or even act as a driver of actions and measures resulting into lower GHG emissions?

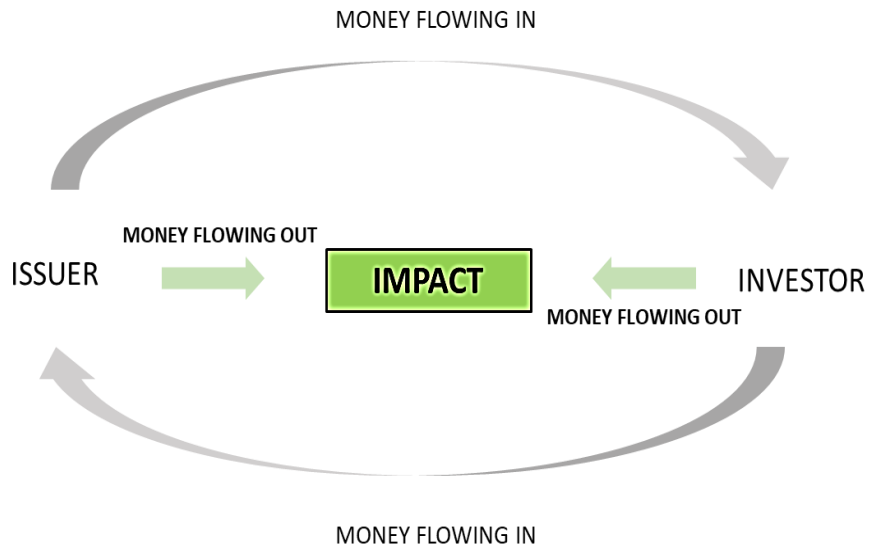


FIGURE 4. Schematic representation of the green bond money flow.

The main goals of the research have been divided in three sections:

- 1) summarization of green bond issuances made by banking sector in the CEE region with specific focus on the first green bond issuance made by selected banks,
- 2) evaluation of environmental impact of green bonds focusing on the transparency and data availability,
- 3) evaluation of environmental commitments publicly communicated by selected banks and their relation to green bond issuance.

3.2 Green Bond Issuance in CEE Banking Sector

Green bonds, specifically issued by banks in the CEE region, have been investigated. The following CEE countries have been selected for the investigation:

- Poland
- Hungary
- Czech Republic
- Serbia

- Lithuania
- Slovak Republic
- Latvia
- Romania
- Slovenia
- Estonia

For each country, the 5 largest banks according to their assets in the national context have been selected for analysis (TABLE 1). The following characteristics have been collected for investigated banks:

- Year of the first green bond issuance.
- Amount and currency of the issued green bond.

The first green bond issuance is an important milestone in the public commitment to green transition. After the first green bond issuance, the level of scrutiny, and the expectations from stakeholders are increasing. There is usually a demand to declare the climate targets and the decarbonization pathway of the bank issuing green bond. The information about the issuance of the first green bond has been collected by researching various channels such as bank's sustainability reports, green bond allocation and impact reports or bank website communication. If no information about the issuance of the first green bond has been retrieved after the screening of aforementioned sources, no green bond issuance has been concluded.

To provide overall picture about the volume of issued green bonds in the CEE region, data have been obtained from Climate Bond Initiative interactive data platform (<https://www.climatebonds.net/market/data/>). The data collection was focused on the emerging European market and green bond issuances. Data for sustainable and social bond issuances has not been evaluated. The research presented herein has been conducted during the 2023, therefore only publicly communicated green bond issuances at this time have been considered.

TABLE 1. The summary of financial institutions selected for analysis in CEE region.

COUNTRY	BANK	OWNER
<i>POLAND</i>	Millenium Bank	Millenium BCP (Portugal)
	ING Bank Slaski	ING Group (Nederland)
	Santander Bank Polska	Santander Group (Spain)
	BNP Paribas Bank Polska	BNP Paribas (France)
	Bank Pekao SA	Bank Pekao (Poland)
<i>HUNGARY</i>	OTP Bank	OTP Group (Hungary)
	Kereskedelmi és Hitelbank	KBC Group (Belgium)
	UniCredit Bank	UniCredit (Italy)
	Erste Bank Hungary	Erste Group (Austria)
	Raiffeisen Bank	Raiffeisen Bank International (Austria)
<i>SLOVAKIA</i>	Vseobecna Uverova Banka	Intesa Sanpaolo (Italy)
	Slovenska Sporitelna	Erste Group (Austria)
	Tatra banka	Raiffeisen Bank International (Austria)
	Ceskoslovenska Obchodna Banka	KBC Group (Belgium)
	UniCredit Bank	UniCredit (Italy)
<i>CZECH REPUBLIC</i>	Ceskoslovenska obchodni	KBC Group (Belgium)
	Ceska Sporitelna	Erste Group (Austria)
	Komerčni banka	Société Générale (France)
	UniCredit	UniCredit (Italy)
	Raiffeisen Bank	Raiffeisen Bank International (Austria)
<i>LITHUANIA</i>	AB Swedbank	Swedbank Group (Sweden)
	AB SEB bankas	Skandinaviska Enskilda Banken (Sweden)
	AB Siauliu bankas	AB Siauliu bankas (Lithuanian)
	UAB Revolut Bank	Revolut (Great Britain)
	UAB Medicinos bankas	UAB Medicinos bankas (Lithuania)
<i>LATVIA</i>	Swedbank AS	Swedbank Group (Sweden)
	AS SEB Banka	Skandinaviska Enskilda Banken (Sweden)
	AS Citadele Banka	Citadele Banka (Latvia)
	AS Rietumu Banka	Rietumu (Latvia)
	BluOr Bank AS	BluOr Bank (Latvia)
<i>ESTONIA</i>	Swedbank AS	AB Swedbank (Sweden)
	AS SEB Pank	Skandinaviska Enskilda Banken (Sweden)
	Nordea Bank AB	Nordea Bank (Finland)
	AS LHV Pank	LHV Bank (Estonia)
	AS Citadele Banka	Citadele Banka (Latvia)

<i>SERBIA</i>	Banca Intesa a.d. Beograd	Intesa Sanpaolo (Italy)
	OTP Banka Srbija	OTP Group (Hungary)
	Vojvodanska banka	OTP Group (Hungary)
	Unicredit Bank Srbija	UniCredit Group (Italy)
	NLB Komercijalna banka	NLB Bank Group (Slovenia)
<i>ROMANIA</i>	Banca Transilvania S.A.	Banca Transilvania (Romania)
	Banka Comerciala Romana S.A.	Erste Group (Austria)
	BRD – Groupe Société Générale	Société Générale (France)
	ING Bank	ING Bank (Nederland)
	Raiffeisen Bank SA	Raiffeisen Bank International (Austria)
<i>SLOVENIA</i>	Nova Ljubljanska Banka	Nova Ljubljanska Banka (Slovenia)
	BKS Bank AG	BKS Bank AG (Austria)
	Nova Kreditna Banka	Nova Kreditna Banka (Slovenia)
	SKB Banka	OTP Group (Hungary)
	Banka Intesa Sanpaolo	Intesa Sanpaolo (Italy)

3.3 Environmental Impact of Green Bonds

To analyse environmental impact of green bonds, the focus was put on impact reporting which is one of the core pillars of the ICMA Green bond principles. The banks with the first green bond already issued have been investigated, available impact reports have been collected and analysed. The main source of the green bond impact report were the websites of the selected banks. The main drawbacks are relatively new green bond issuances where it is challenging to measure real environmental impact, and the fact that first impact reports are due the year from the green bond issuance. Some of the banks with the first green bond already issued did not publish their impact report at the time of herein presented analysis.

From the available impact reports published by selected banks, the characteristics of green projects have been evaluated. When analysing impact reports, the eligible category of green project and impact metrics have been considered. In summary, analysis of green bonds environmental impact has been performed as follows:

- available impact reports of investigated banks have been retrieved from websites,

- categories of financed green projects have been identified in line with the definition of eligible green projects in ICMA Green bond principles,
- the impact metrics disclosed for financed green projects have been evaluated.

Greenhouse gas emissions produced at the country's level have been analysed as well to discuss the environmental impact of green bonds in broader context. The identification of high carbon producing sectors allows to better evaluate the relevance of financed green projects using the proceeds raised by green bond issuance. The data for GHG emissions generated by various sectors for the selected CEE countries have been collected from database available at <https://our-worldindata.org/>.

3.4 Environmental Commitments in Banking Sector

The purpose was to analyse the public communication of environmental commitments and targets made by banks. The analysis aimed to identify whether there are differences in communication of environmental targets between banks which already issued the first green bond and banks with no green bond issuance.

The analysis was predominantly based on the sustainability reports and websites of selected banks. The analysis evaluated the communication of short, medium, and long-term environmental targets. The focus was put on the identification of quantitative climate targets aligned with Agenda 2030, Paris Agreement and/or European Green Deal. Quantitative climate targets can be understood as specific decarbonization goals set by bank to reduce the direct emissions from own operations and/or emissions from financing portfolio. Especially in the banking sector, the main portion of carbon footprint is represented by indirect emissions derived from the financed portfolio. In simple words, financing businesses such as fossil fuels or coal is generating significant indirect carbon footprint for the bank as well. On the other side, financing of green activities, ideally activities aligned with the EU taxonomy reduces the carbon footprint of the portfolio. The position of the bank towards financing “brown” activities is crucial and indicates whether the

bank has clear plan to achieve net-zero by 2050. Vague climate commitments without quantitative back-up have not been considered as relevant.

4 RESULTS

4.1 Green Bond Issuers in CEE Banking Sector

Green bond issuances made by financial sector have been analysed in selected Central and Eastern European (CEE) countries. Specifically, the 5 largest banks according to their assets have been in scope of analysis for each country. The following CEE countries have been analysed: Poland, Hungary, Czech Republic, Serbia, Lithuania, Slovak Republic, Latvia, Romania, Slovenia, Estonia.

Data available at the Climate Bonds Initiative platform (<https://www.climatebonds.net/market/data/>) has been analysed. Poland and Hungary were evaluated as the leading green bond issuers among the selected CEE countries. On the other side, Slovenia and Estonia are in the beginning of green bond journey. Other countries – Czech Republic, Serbia, Lithuania, Slovakia were at the similar level in terms of issued volume of green bonds (FIGURE 5).

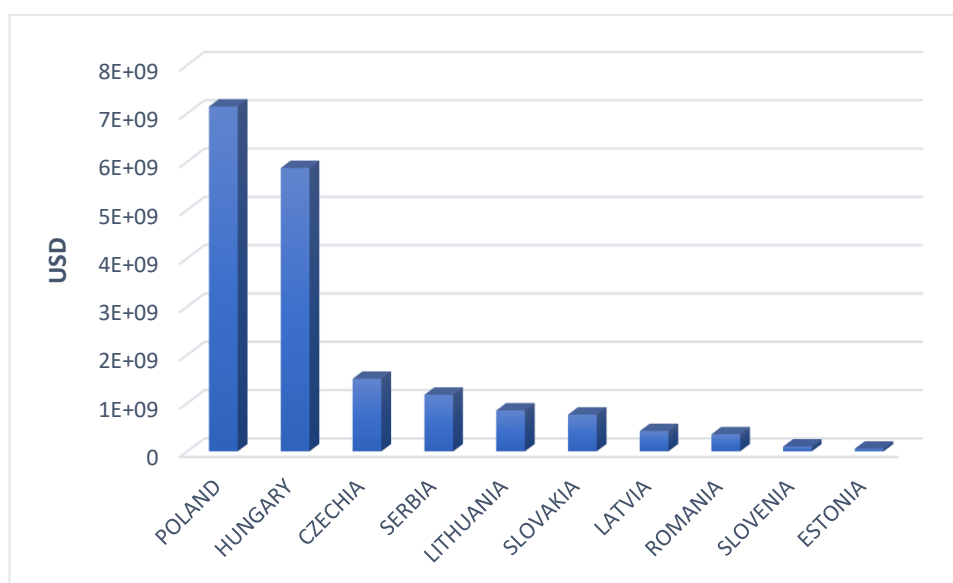


FIGURE 5. The cumulative amount of green bonds (in USD) issued by CEE countries during the 2015-2022 timeframe (<https://www.climatebonds.net/market/data/>).

Then, green bond issuances have been analysed according to the issuer type over the time 2015 – 2022. First green bond was issued by financial corporate in 2017, however during the years 2015 – 2018, green bonds were issued mainly

by sovereign, governmental or non-financial corporate issuers. In the selected CEE region, sovereign and non-financial corporate issuers were prevailing also in 2021 – 2022, however the volumes of green bonds issued by financial institutions started to increase as well (FIGURE 6). The findings indicate that bank's green bond issuances are relatively new area where the actual impact of the proceeds raised from investors needs to be evaluated.



FIGURE 6. Green bonds issued in the CEE region during 2015-2022 timeframe (<https://www.climatebonds.net/market/data/>).

The important aspect of the presented research was to identify the year of the first green bond issuance. It is considered a significant milestone in bank public declaration of climate goals and support of green transition. The information was collected from available resources such as bank's sustainability report, green bond allocation and impact report, green bond framework, sustainable finance framework or websites of selected banks (TABLE 2).

TABLE 2. The 5 largest banks according to their assets per each selected CEE country. Table displays a year of first green bond issuance, volume, and currency of the issued bond.

COUNTRY	BANK	YEAR OF ISSUANCE	VOLUME
<i>POLAND</i>	Millenium Bank	No issuance	-
	ING Bank Slaski	2019	ZL 400mn
	Santander Bank Polska	2017	EUR 137mn
	BNP Paribas Bank Polska	No issuance	
	Bank Pekao SA	2023	EUR 500mn
<i>HUNGARY</i>	OTP Bank	2022	EUR 400mn
	Kereskedelmi és Hitelbank	2022	HUF 15bln
	UniCredit Bank	2021	HUF 23.20bln
	Erste Bank Hungary	2021	HUF 10.43bln
	Raiffeisen Bank	No issuance	-
<i>SLOVAKIA</i>	Vseobecna Uverova Banka	No issuance	-
	Slovenska Sporitelna	2021	EUR 154mn
	Tatra banka	2021	EUR 300mn
	Ceskoslovenska Obchodna Banka	No issuance	-
	UniCredit Bank	2023 ¹	EUR 500mn
<i>CZECH REPUBLIC</i>	Ceskoslovenska obchodni	2023	CZK 1bln
	Ceska Sporitelna	2021	EUR 500mn
	Komerčni banka	No issuance	-
	UniCredit	2023 ¹	EUR 500mn
	Raiffeisen Bank	2021	EUR 350mn
<i>LITHUANIA</i>	AB Swedbank	No issuance	-
	AB SEB bankas	2017 ²	EUR 20mn
	AB Siauliu bankas	2021	EUR 8mn
	UAB Revolut Bank	No issuance	-
	UAB Medicinos bankas	No issuance	-
<i>LATVIA</i>	Swedbank AS	No issuance	-
	AS SEB Banka	No issuance ⁴	-
	AS Citadele Banka	No issuance	-
	AS Rietumu Banka	No issuance	-
	BluOr Bank AS	No issuance	-
<i>ESTONIA</i>	Swedbank AS	No issuance	-
	AS SEB Pank	No issuance	-
	Nordea Bank AB	No issuance	-
	AS LHV Pank	No issuance	-
	AS Citadele Banka	No issuance	-
<i>SERBIA</i>	Banca Intesa a.d. Beograd	No issuance	-
	OTP Banka Srbija	No issuance	-
	Vojvodanska banka	No issuance	-
	Unicredit Bank Srbija	No issuance	-

	NLB Komercijalna banka	No issuance	-
ROMANIA	Banca Transilvania S.A.	No issuance	-
	Banka Comerciala Romana S.A.	2021	RON 500mn
	BRD – Groupe Soci�t� G�n�rale	No issuance	-
	ING Bank	No issuance	-
	Raiffeisen Bank SA	2021	RON 400.575mn
SLOVENIA ⁵	Nova Ljubljanska Banka	2023	EUR 500mn
	BKS Bank AG	No issuance	-
	Nova Kreditna Banka	No issuance	-
	SKB Banka	No issuance	-
	Banka Intesa Sanpaolo	No issuance	-

Notes:

¹ Joined issuance of green bond by Unicredit Czech Republic and Unicredit Slovakia.

² SEB bankas acted as the arranging bank for the green bond transaction.

⁴ SEB banka Latvia issued the first Green loan of EUR 6mn to support implementation of the beverage packaging deposit system in Latvia in 2021 (SEB, 2021).

⁵ SID Banka (Slovenska Izvozna In Razvojna Banka, Ljubljana; 7th largest bank in Slovenia), first green bond EUR 75mn issued in 2018, first Slovenian green bond issued on international capital market (SeeNews, 2018).

Interestingly, out of the 50 analysed banks, 31 banks have not issued the first green bond as of end of December 2023 (or there was no available communication at this moment). The highest volumes of issued green bonds in the selected area have been observed in 2021 when 8 banks issued the first green bond followed by 2 banks in 2022, and 6 banks issued their first green bond only recently in 2023. Due to the fact that majority of green bonds have been issued only recently, the evaluation of the real environmental impact is challenging.

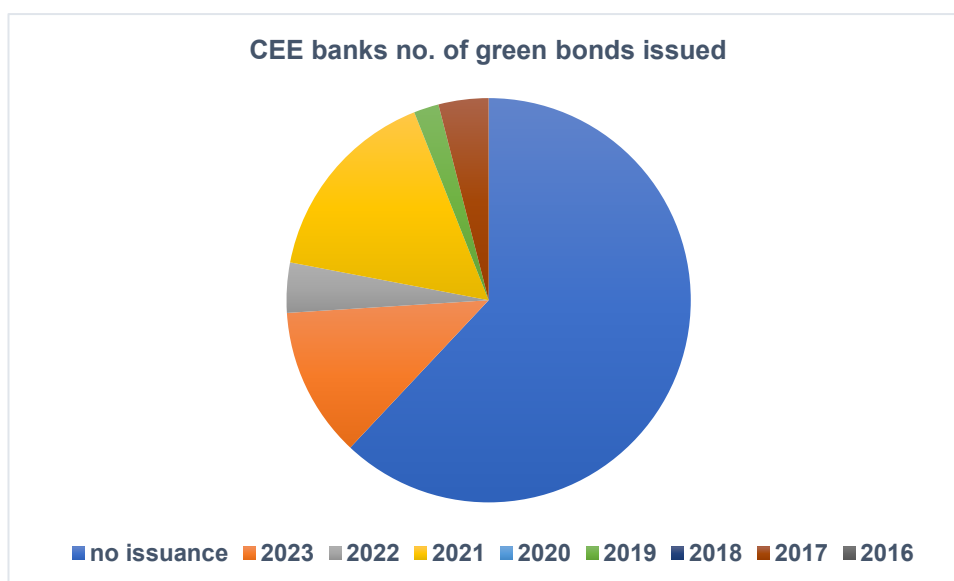


FIGURE 7. The proportion of green bonds issued by selected banks in the CEE region during the years 2016 - 2023.

4.2 Environmental Impact of Green Bonds

The ultimate goal of green bond issuance is to channel investments towards projects speeding up the green transition. Green bonds need to attract investors with non-pecuniary motives besides the financial ones and provide the values with dimension exceeding traditional bond issuances. Herein, the green bond product connects the aspects of financial prosperity and environmental benefits.

Thus, it is important to identify into what kind projects are proceeds raised from green bond issuance invested. Banks issuing green bonds are voluntarily publishing the green bond allocation and impact report which is one of the recommended market practices by ICMA. For the purpose of this research, the supported green projects have been identified from available impact reports. The limitation of the study is the recent issuance of green bonds, thus for some green bonds, no allocation and impact report have been published yet.

Based on the available data, majority of the green bond's financing goes into green buildings, renewable energy, and clean transportation projects (TABLE 3). The table below summarizes the eligible green categories as defined by ICMA Green bond principles in which the respective investments have been made. In total, 19 banks from the research sample have been identified to issue the first

green bond. The following countries are represented: Poland, Hungary, Czech Republic, Lithuania, Slovakia, Romania and Slovenia.

Three main financed green project categories have been identified as follows: green buildings, renewable energy and clean transportation.

TABLE 3. Green bond use of proceeds identified for selected banks.

COUNTRY	BANK	USE OF PROCEEDS
<i>POLAND</i>	ING Bank Slaski	Green buildings
	Santander Bank Polska	Green buildings, Renewable energy, Clean transportation, Sustainable Agriculture, Circular Economy
	Bank Pekao SA	Not available
<i>HUNGARY</i>	OTP Bank	Green buildings, Renewable energy, Clean transportation
	Kereskedelmi és Hitelbank	Not available
	UniCredit Bank	Green buildings, Renewable energy, Clean transportation
	Erste Bank Hungary	Not available
<i>SLOVAKIA</i>	Slovenska Sporitelna	Green buildings
	Tatra banka	Green buildings, Renewable energy, Clean transportation
	UniCredit Bank	Not available
<i>CZECH REPUBLIC</i>	Ceskoslovenska obchodni	Not available
	Ceska Sporitelna	Green buildings, Renewables energy
	UniCredit	Not available
	Raiffeisen Bank	Green buildings, Renewable energy, Sustainable Forestry and Agriculture, Clean transportation
<i>LITHUANIA</i>	AB SEB bankas	Green buildings, Renewable energy, Sustainable Forestry and Agriculture, Clean transportation, Pollution prevention, Circular economy
	AB Siauliu bankas	Not available
<i>ROMANIA</i>	Banka Comerciala Romana S.A.	Green buildings
	Raiffeisen Bank SA	Green buildings, Clean transportation, Sustainable agriculture
<i>SLOVENIA</i>	Nova Ljubljanska Banka	Not available

4.3 Greenhouse Gas Emissions Produced at the Country Level

To put environmental impact of green bonds into broader context, it is crucial to investigate the GHG emissions produced at the country level. This allows to investigate whether the green investments are going into the pressing areas responsible for main portion of GHG emissions in the respective country.

Firstly, the level of GHG emissions in tCO₂ per capita have been compared for the period before first green bond issuances in the CEE region (2015) and after the development of green bond market (2021) (TABLE 4). Interestingly, when comparing the overall level of GHG emissions produced per country, Poland and Hungary identified as the main green bond issuers showed increased GHG emissions in 2021 in comparison to the pre-issuance year 2015. On the other side, Estonia and Slovenia considered to be in the beginning of the green bond journey have showed improvement in the country overall GHG emissions.

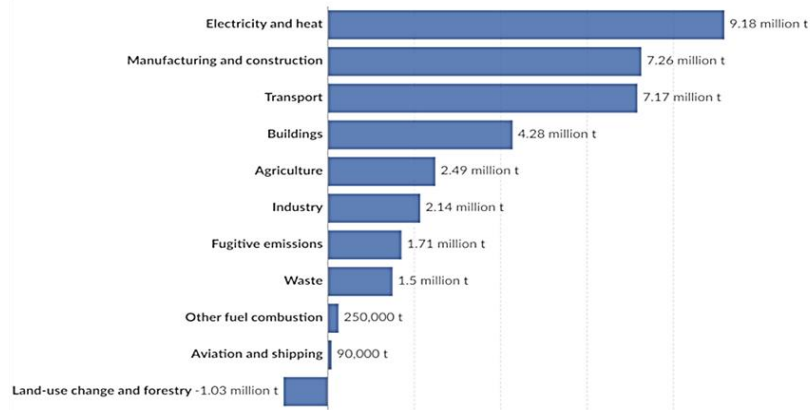
TABLE 4. Comparison of tCO₂ produced per capita in selected countries in year 2015 and 2021 (<https://ourworldindata.org/>).

	2015	2021
Poland	8,1	8,6
Hungary	4,7	5
Slovak Republic	6,4	6,5
Czech Republic	10	9,2
Slovenia	6,6	5,9
Estonia	12,1	7,9
Lithuania	4,5	5
Latvia	3,6	3,9
Romania	3,9	4,1
Serbia	5,8	4,2

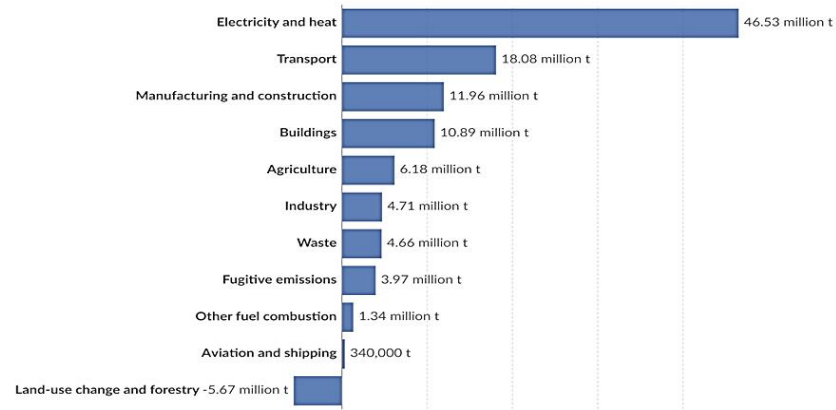
Based on the analysis, the industry-sectors producing the main portion of GHG emissions are electricity and heat production, transport, manufacturing and construction, and buildings. The main source of country GHG emissions is the production of electricity and heat in the majority of analysed countries: Poland, Hungary, Slovakia, Czech Republic, Romania and Serbia. The different pattern was

observed for Estonia with majority of country GHG emissions produced by land use and forestry. Moreover, the main producer of GHG emissions in Latvia is agriculture. Slovenia and Lithuania showed transport as the main source of GHG emissions. The detailed breakdown of GHG emissions into categories based on the industry is shown in FIGURE 8. The analysis provides clear overview of the sectors in which the green financing should be directed to decrease the produced GHG emissions.

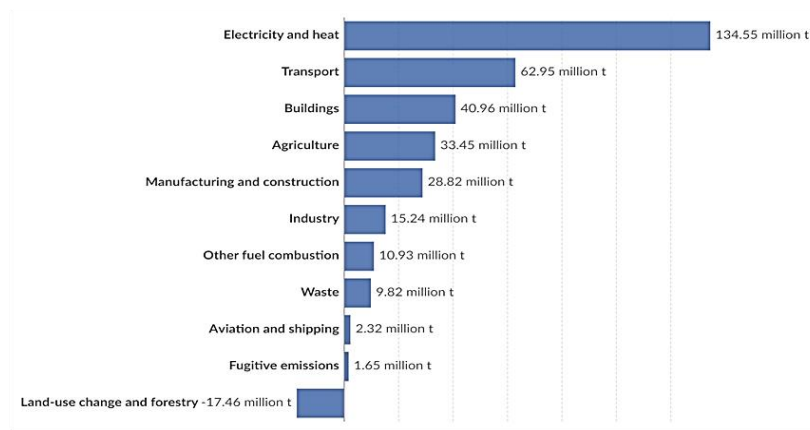
Slovak Republic



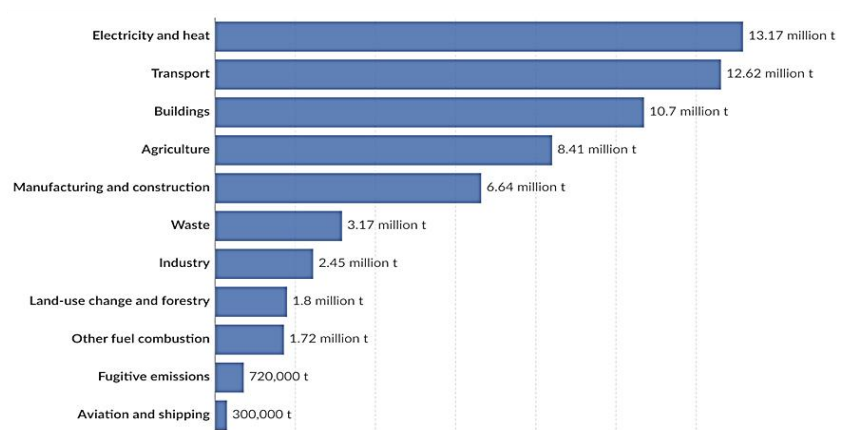
Czech Republic



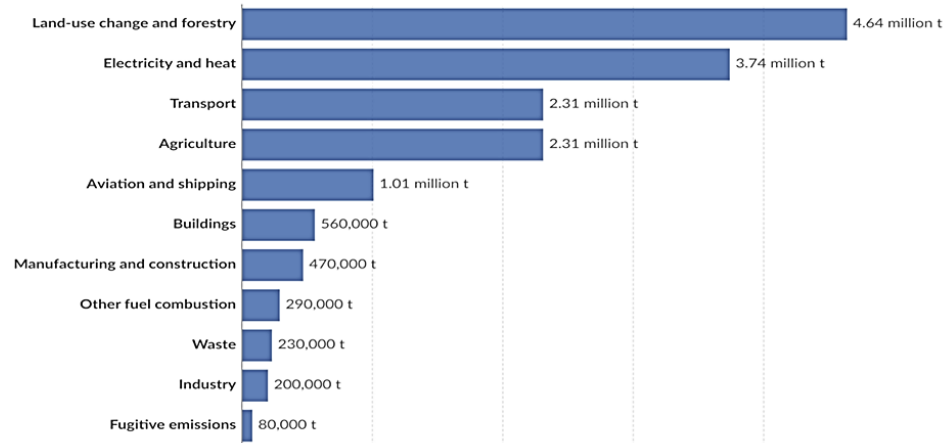
Poland



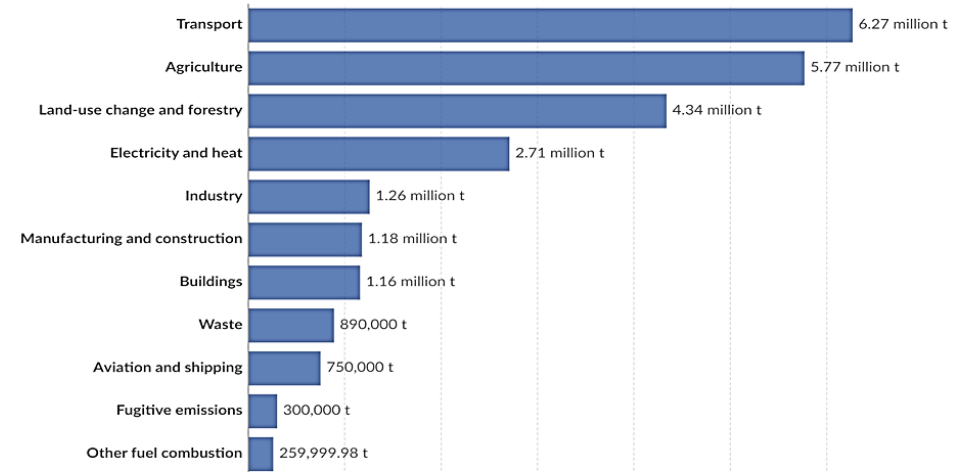
Hungary



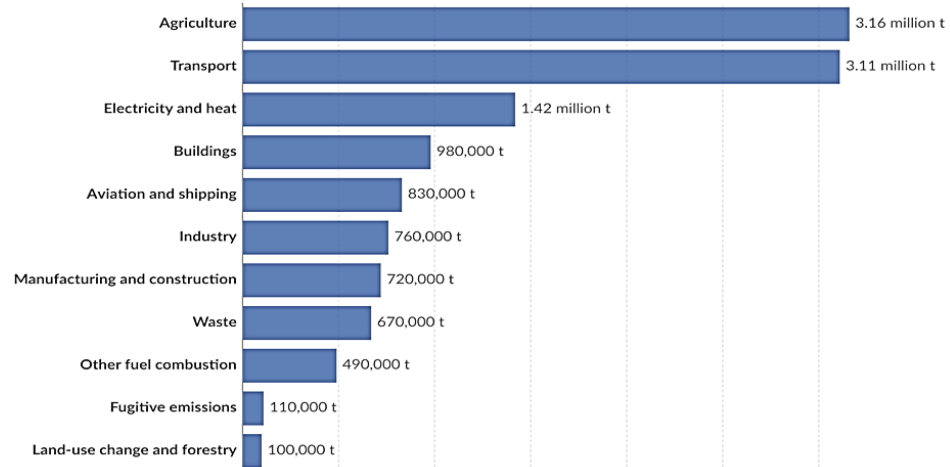
Estonia



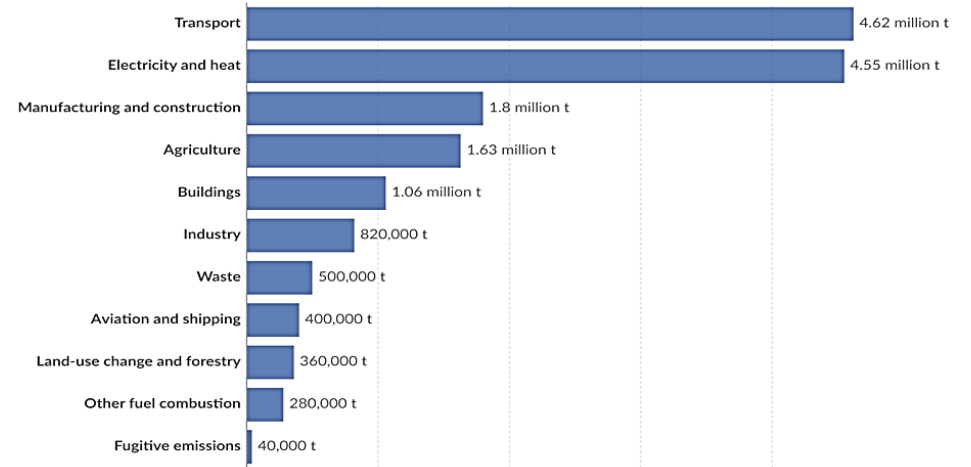
Lithuania



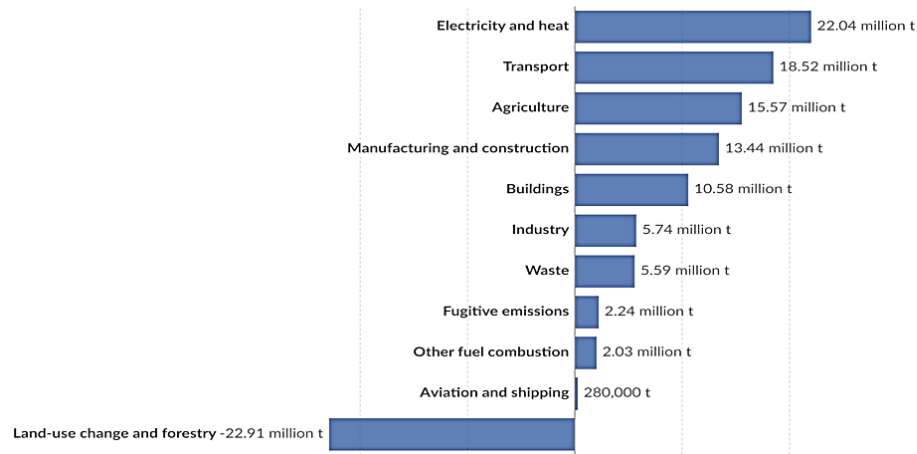
Latvia



Slovenia



Romania



Serbia

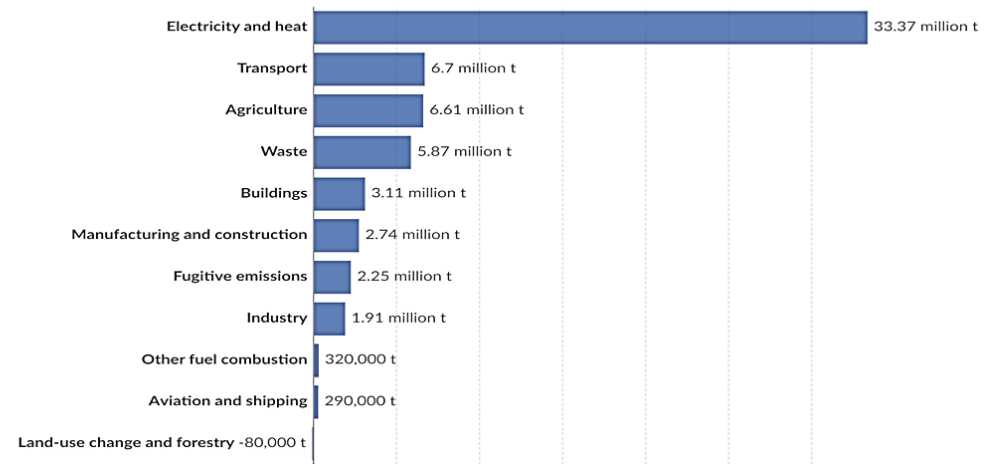


FIGURE 8. GHG emissions in tCO₂e produced by industry sectors in 2020 for selected countries (<https://ourworldindata.org/>).

4.4 Effect of Green Bond Issuance on Environmental Commitments

The research below summarizes the short-/medium-/or long-term environmental goals set by banks according to the latest publicly available materials (TABLE 5). Majority of analysed banks are subsidiaries of large banking group, and the climate goals are mostly aligned at the group level. Table below summarizes the identified climate goals publicly communicated by banks in scope of this study. The study has been focusing on the quantitative goals which can be measured overtime. The vague climate commitments such as self-declarations, manifests, or other types of marketing communications with no data support have not been taken into account. The main goal of the analysis was to point out the most relevant climate targets aligned with Agenda 2030, Paris Agreement and European Green Deal. Therefore, other environmental activities of the studied banks such as green products and services have not been in scope of the presented analysis. However, it needs to be disclosed that all selected banks communicated ESG and/or sustainability at certain level. Usually, environmental activities such waste reduction or usage of green electricity have been communicated. Some of the banks are disclosing carbon footprint generated by own operations (direct emissions), and through investment and lending portfolios (indirect emissions). Also, some of the analysed banks are counting on carbon offsetting projects to help them achieve their climate goals.

TABLE 5. Climate targets aligned with Paris Agreement and EU Green Deal publicly communicated by analysed banks. No specific climate targets communicated means that no quantitative targets aligned with Paris Agreement or Net-zero targets have been publicly declared. Highlighted in green are banks with the green bond already issued.

COUNTRY	BANK	CLIMATE TARGETS
POLAND	Millenium Bank	<ul style="list-style-type: none"> ✓ Environmental policy of no financing new coal mining, coal-based energy. ✓ Climate neutrality in Scope 1 and 2 by 2027. ✓ Climate neutrality of the financing portfolio (Scope 3) by 2050.
	ING Bank Slaski	<ul style="list-style-type: none"> ✓ Climate neutrality in Scope 1 and 2 by 2030. ✓ Reduction of fossil fuel financing 19% by 2040 (in comparison to 2019).
	Santander Bank Polska	<ul style="list-style-type: none"> ✓ No financing to thermal coal producers from 2030. ✓ Climate neutrality of the financing portfolio (Scope 3) by 2050.
	BNP Paribas Bank Polska	<ul style="list-style-type: none"> ✓ Climate neutrality of the financing portfolio (Scope 3) by 2050. ✓ Full exit of the thermal coal value chain including investments and financing by 2040.
	Bank Pekao SA	<ul style="list-style-type: none"> ✓ Climate neutrality of own operations by 2030.
HUNGARY	OTP Bank	<ul style="list-style-type: none"> ✓ No specific emission reduction targets communicated.
	Kereskedelmi és Hitelbank	<ul style="list-style-type: none"> ✓ Declared carbon neutrality of the own operations from 2022 (carbon offsetting projects have been used). ✓ Financing targets for the different parts of portfolio (e.g. reduce CO₂ from steel by 14%, cement 16%, real estate 38%).
	UniCredit Bank	<ul style="list-style-type: none"> ✓ Climate neutrality of own operations by 2030. ✓ Climate neutrality of the financing portfolio (Scope 3) by 2050.
	Erste Bank Hungary (ERSTE Group)	<ul style="list-style-type: none"> ✓ Reduction of total scope1+2 emissions -80% by 2030. ✓ Increase share of green electricity usage 90% by 2023. ✓ Enlarge own electric car fleet 25% by 2025. ✓ Reduction of financed emissions from mortgages (-43%, -98%), real estate (-50%, -98%), energy production (-49%, -95%), heat generation (-42%, -90%) by 2030, and 2050, respectively.
	Raiffeisen Bank ((Raiffeisen Group)	<ul style="list-style-type: none"> ✓ Reduction of scope 1 and 2 emissions 25% by 2030 (in comparison to 2020). ✓ Scope 3 portfolio targets: reduction GHG emissions from financing electricity generation -48% per MWh, from real estate sector -56% per m².
SLOVAKIA	Vseobecna Uverova Banka (Intesa Sanpaolo)	<ul style="list-style-type: none"> ✓ Climate neutrality by 2050, however at the website of Slovak branch is missing the clear explanation how the target will be achieved.

	Slovenska Sporitelna (ERSTE Group)	<ul style="list-style-type: none"> ✓ Reduction of total scope1+2 emissions -80% by 2030. ✓ Increase share of green electricity usage 90% by 2023. ✓ Enlarge own electric car fleet 25% by 2025. ✓ Reduction of financed emissions from mortgages (-43%, -98%), real estate (-50%, -98%), energy production (-49%, -95%), heat generation (-42%, -90%) by 2030, and 2050, respectively.
	Tatra banka (Raiffeisen Group)	<ul style="list-style-type: none"> ✓ Reduction of scope 1 and 2 emissions 25% by 2030 (in comparison to 2020). ✓ Scope 3 portfolio targets: reduction GHG emissions from financing electricity generation -48% per MWh, from real estate sector -56% per m².
	Ceskoslovenska Obchodna Banka (KBC Group)	<ul style="list-style-type: none"> ✓ No specific climate targets communicated by Slovak branch.
	UniCredit Bank	<ul style="list-style-type: none"> ✓ No specific climate targets communicated for the Slovak branch.
CZECH REPUBLIC	Ceskoslovenska obchodni banka (KBC Group)	<ul style="list-style-type: none"> ✓ Expected timeframe is not clearly set for some goals - Increase the ratio of renewables financing to 75% of loan portfolio. ✓ Reduction of portfolio carbon footprint in the energy sector by 39%. ✓ Scope 1 carbon footprint reduction 80% by 2030 in comparison to 2015 ✓ Full carbon neutrality by 2050 (not specified how this will be achieved).
	Ceska Sporitelna (ERSTE Group)	<ul style="list-style-type: none"> ✓ Reduction of total scope1+2 emissions -80% by 2030. ✓ Increase share of green electricity usage 90% by 2023. ✓ Enlarge own electric car fleet 25% by 2025. ✓ Reduction of financed emissions from mortgages (-43%, -98%), real estate (-50%, -98%), energy production (-49%, -95%), heat generation (-42%, -90%) by 2030, and 2050, respectively.
	Komerčni banka (Société Générale)	<ul style="list-style-type: none"> ✓ 50 % of investment loans issued to corporate clients will be aligned with EU Taxonomy and/or with the Société Générale Groups Sustainable and Positive Impact Finance parameter by 2050
	UniCredit	<ul style="list-style-type: none"> ✓ No specific climate targets communicated for the Czech branch.
	Raiffeisen Bank (Raiffeisen Group)	<ul style="list-style-type: none"> ✓ Reduction of scope 1 and 2 emissions 25% by 2030 (in comparison to 2020). ✓ Scope 3 portfolio targets: reduction GHG emissions from financing electricity generation -48% per MWh, from real estate sector -56% per m².
	LITHUANIA	AB Swedbank (Swedbank Group)

	AB SEB bankas	<ul style="list-style-type: none"> ✓ Net-zero carbon footprint from own operations by 2045 (66% by 2025 and 75% by 2030), carbon compensation projects may be involved. ✓ Net-zero commitment from lending and investment portfolios by 2050.
	AB Siauliu bankas	<ul style="list-style-type: none"> ✓ No specific climate targets communicated.
	UAB Revolut Bank	<ul style="list-style-type: none"> ✓ No specific climate targets communicated.
	UAB Medicinos bankas	<ul style="list-style-type: none"> ✓ No specific climate targets communicated.
LATVIA	Swedbank AS (Swedbank Group)	<ul style="list-style-type: none"> ✓ Lending portfolio climate targets: reduction of financed emissions for mortgages 39%, for real estate 43%, oil and gas 50%, power generation 59%, steel 29%.
	AS SEB Banka	<ul style="list-style-type: none"> ✓ Net-zero carbon footprint from own operations by 2045 (66% by 2025 and 75% by 2030), carbon compensation projects may be involved. ✓ Net-zero commitment from lending and investment portfolios by 2050.
	AS Citadele Banka	<ul style="list-style-type: none"> ✓ Carbon neutrality of own operation by 2023.
	AS Rietumu Banka	<ul style="list-style-type: none"> ✓ No specific climate targets communicated.
	BluOr Bank AS	<ul style="list-style-type: none"> ✓ No specific climate targets communicated.
ESTONIA	Swedbank AS (Swedbank Group)	<ul style="list-style-type: none"> ✓ Lending portfolio climate targets: reduction of financed emissions for mortgages 39%, for real estate 43%, oil and gas 50%, power generation 59%, steel 29%.
	AS SEB Pank	<ul style="list-style-type: none"> ✓ Net-zero carbon footprint from own operations by 2045 (66% by 2025 and 75% by 2030), carbon compensation projects may be involved. ✓ Net-zero commitment from lending and investment portfolios by 2050.
	Nordea Bank AB	<ul style="list-style-type: none"> ✓ Reduction of carbon emissions from own operation 50%, and from lending and investment portfolios 40-50% by 2030 (in comparison to 2019). ✓ Climate neutrality by 2050. ✓ Full phase-out of mining financing achieved in 2021. ✓ Decarbonization pathway of the financing portfolio clearly set by individual reduction target for each financed sector.
	AS LHV Pank	<ul style="list-style-type: none"> ✓ No specific climate targets communicated.
	AS Citadele Banka	<ul style="list-style-type: none"> ✓ Carbon neutrality of own operation by 2023.
SERBIA	Banca Intesa a.d. Beograd	<ul style="list-style-type: none"> ✓ Shares climate targets within Intesa Sanpaolo Group. ✓ Climate neutrality of own operations by 2030. ✓ Net-zero by 2050.
	OTP Banka Srbija	<ul style="list-style-type: none"> ✓ No specific climate targets communicated.
	Vojvodanska banka	<ul style="list-style-type: none"> ✓ No specific climate targets communicated.
	Unicredit Bank Srbija	<ul style="list-style-type: none"> ✓ No specific climate targets communicated at the Serbia branch website.

	NLB Komercijalna banka	✓ No specific climate targets communicated.
ROMANIA	Banca Transilvania S.A.	✓ No specific climate targets communicated.
	Banka Comerciala Romana S.A. (ERSTE Group)	✓ Shared net-zero targets by 2050 within Group level. ✓ No specific climate targets communicated on the Romanian branch website.
	BRD – Groupe Société Générale	✓ No specific climate targets communicated on the Romanian branch website.
	ING Bank	✓ Climate neutrality of own operations by 2030 and net-zero by 2050 shared at the ING Group level. ✓ No specific climate targets communicated on the Romanian branch website.
	Raiffeisen Bank SA	✓ Reduction of scope 1 and 2 emissions 25% by 2030 (in comparison to 2020). ✓ Scope 3 portfolio targets: reduction GHG emissions from financing electricity generation -48% per MWh, from real estate sector -56% per m ² .
SLOVENIA	Nova Ljubljanska Banka	✓ Lending and investment portfolio net-zero targets
	BKS Bank AG	✓ No specific climate targets communicated on the Romanian branch website.
	Nova Kreditna Banka	✓ No specific climate targets communicated on the website.
	SKB Banka	✓ Scope 1 and 2 emission reduction targets 45% by 2030
	Banka Intesa Sanpaolo	✓ Shares climate targets within Intesa Sanpaolo Group. ✓ Climate neutrality of own operations by 2030. ✓ Net-zero by 2050.

5 DISCUSSION

5.1 Green Bond Issuance by Financial Institutions in CEE Region

In general, Europe is considered a leading continent when discussing green transition and achievement of net-zero economy. Initiatives such as the Paris Agreement and European Green Deal are setting an ambitious plan to decarbonize European economy. These goals require significant capital from private investors. However, there are significant differences at the level of green transition when comparing different European regions. It is necessary to speed up the transformation also in the region of Central and Eastern Europe to achieve the common European commitment of net-zero by 2050. Green bonds can represent a fundamental tool to help finance green transition.

The analysis performed herein has been focusing on the analysis of green bond market in the selected CEE countries, specifically from the position of green bond issuances made by private regional banks. The investigation focused on the CEE countries as follows: Hungary, Poland, Czech Republic, Slovakia, Estonia, Latvia, Lithuania, Romania, Slovenia and Serbia. For the analysis, five largest banks have been selected according to their assets for each country. Initially, the first green bond issuances by the selected banks have been reviewed. The issuance of the first green bond might be understood as public commitment to finance green transition and put focus on the projects with positive environmental outcome.

The interesting observation is that more than a half of analyzed banks out of the 50 did not issue the first green bond by the date of herein performed analysis. Poland has the leading position in the green bond issuance among the selected countries when looking at the cumulative amount of green bonds issued between the years 2015 – 2022. Moreover, analyzing the banking sector issuances, Santander Bank Polska issued the first green bond already in 2017, and then followed by ING Bank Śląski in 2019.

The year 2021 appears to be game changing in the CEE banking sector. The prevalent amount of first green bond issuances by financial institutions have been

made in 2021, majority of them in EUR currency. Selected banks in three countries, namely Latvia, Estonia and Serbia did not issue the first green bond yet. These countries issued up to this date solely sovereign green bonds, however the issuance coming from private banking sector was not observed.

Akomea-Frimpong et al. (2020) identified green bonds as one of the key green finance instruments. Furthermore, the study pointed out the most fundamental determinants of introduction green finance in banking such as risks, regulations targeting the banking sector, bank size, environmental policies and climate change, internal practices and ethics, technology and innovation, interest rates, and social inclusion.

There might be discussed several reasons of slower developing green bond market in the CEE region when comparing with western European countries. Firstly, the lack of strong governmental support for green transition is often the case. Green transition with its climate goals, and adjacent green regulations are often presented as a burden not an opportunity. Secondly, scarce interest from clients to finance green transition of their businesses can create hesitation on the bank side whether it is truly necessary to raise money for green financing. Moreover, issuers of green bonds in CEE region might be challenged by risk of greenwashing. Also, investors prefer bonds issued by issuers from high-income countries because of clearly defined metrics, and less risk of greenwashing.

When investigating the investors preferences, the following factors have been identified as a drivers of investors decisions:

- Investors are interested in high climate impact and want to invest in projects targeting lower GHG emissions in high emitting sectors.
- Clearly defined use of proceeds, and transparent post-issuance reporting.
- Corporate issuances are preferred channel.
- Policies and regulations are pushing investors for greening their portfolios.
- Issuer susceptibility to greenwashing allegations.
- Green bond EU taxonomy alignment.

- Issuer strong sustainability credentials (European Green Bond European Investor Survey, 2019).

5.2 Environmental Impact of Green Bonds

Concluding from the fact that the first green bond issuances in the selected CEE countries have been made relatively recently, it is challenging to estimate whether they are positively contributing towards green transition. Currently, only source of information about environmental impact of green bonds is the report commonly known as “allocation and impact report”. Reporting is one of the core pillars of the Green bond principles developed by ICMA. Green bond issuers are expected to report on green bond proceeds allocation and impact starting one year after the green bond issuance. Although, these principles are voluntary, it was observed that banks in scope of herein presented research met the reporting requirement. The reports have been collected for banks identified as green bond issuer, then the types of supported green projects have been evaluated. The analysis showed that the main portion of green bond financing is channeled towards green buildings, renewable energy projects and clean transportation. Only minority of studied banks invested raised proceeds into sustainable forestry and agriculture or circular economy. It can be concluded that the range of supported green projects is quite narrow, the green buildings sector is dominating. On the one hand, it was observed that generation of heat and electricity, transportation and buildings are among the main sources of GHG emissions in the selected CEE countries. On the other side, there is significant deficiency of capital directed into prevention of pollution including financing of green technologies, water management or circular economy.

According to the data published by European Environment Agency (2023) (FIGURE 9), the buildings sector is one of the main contributors to the GHG emissions. In 2021, buildings were responsible for 35% of energy-related emissions in European Union, mostly because of the direct use of fossil fuels and from the basic building operations such as production of electricity and heat. Decarbonization of the building sector is one of the top priorities in Europe, new constructions need to fulfill stricter regulatory criteria requiring the use of renewable en-

ergy resources. Also, renovations of existing buildings play a crucial part in decarbonization of building sector. Herein, the improvement in energy efficiency is essential. Thus, investments towards decarbonization of building sector appear to have positive environmental contribution.

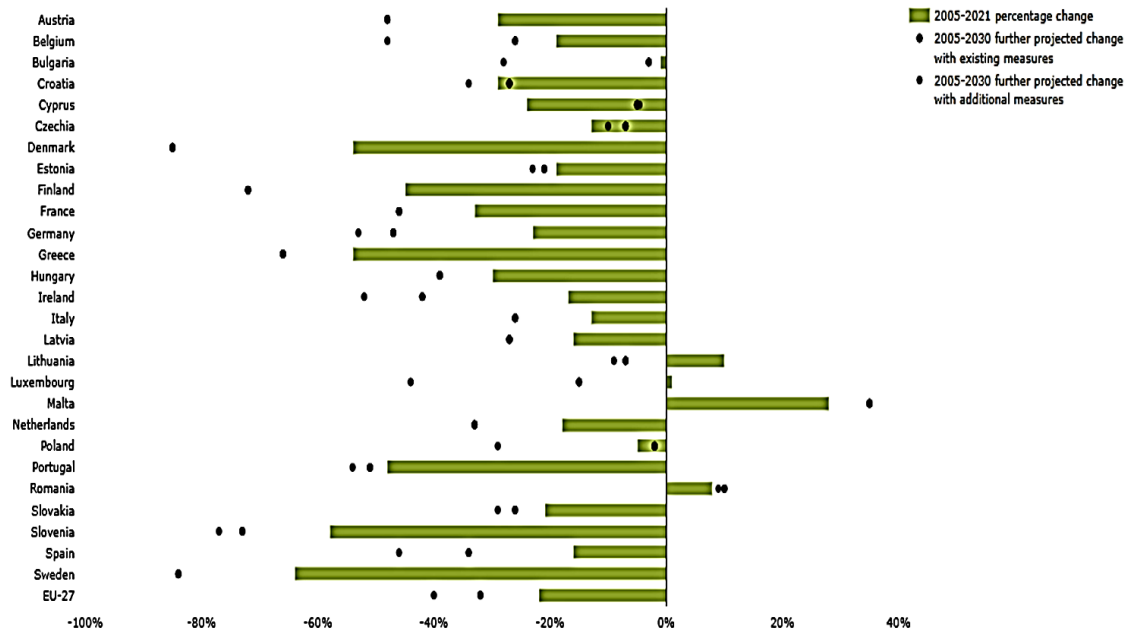
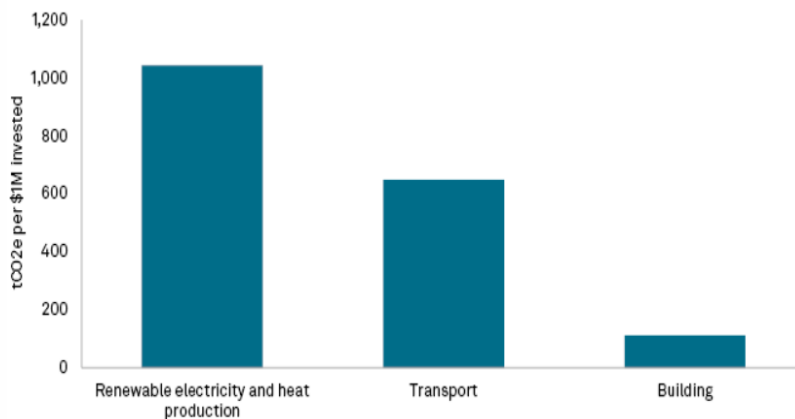


FIGURE 9. Greenhouse gas emissions from energy use in buildings in Europe (European Environment Agency, 2022).

However, investments in new constructions, and renovations often represent more than a half of green bond portfolio. It might be disputable whether unidirectional focus on green buildings brings a real environmental benefit. Despite not very diversified green bond portfolios, financing green building projects appears to be of a great significance. European Environment Agency (2022) estimates that energy renovations of buildings must at least double to meet the climate targets 2030.

Helfre and Depetiteville (2022) consulted that the impact of green buildings is in terms of avoided emissions much lower in comparison to the renewable energy or clean transportation projects (FIGURE 10). Moreover, the analysis showed that the green bond financing of renewable energy projects in Africa has the most significant impact in terms of avoided emissions of carbon dioxide. This can be explained by the high carbon intensity of the current electricity mix in Africa comparing to the relatively low carbon intensity of the electricity mix in Europe. Wang

and Taghizadeh-Hesary (2023) analyzed issued green bonds in 15 member economies of the Organisation for Economic Co-operation and Development (OECD) and the impact on renewable energy development. The study concluded the impact of green bonds on increase in wind and hydroenergy use in this region. However, no significant impact on the use of solar energy was observed.



Data as of Sept. 12, 2022.

FIGURE 10. Impact of green projects financed through green bonds estimated as avoided emissions carbon dioxide equivalent in tons (Helfre and Depetiteville, 2022).

These observations are pointing out the fact that the project can be green, however the additional positive impact may nevertheless be minimal. The same type of green project can have different impact depending on the region. Therefore, among the issued green bonds can be huge differences in terms of impact. Herein, the introduction of stricter standards such EU Green Bond Standard can be more than beneficial. It is essential to increase transparency and support investments in truly green projects, thus the common taxonomy defining the „greenness“ is desired.

Heavy industries are other topic for discussion, these sectors are essential players in achieving decarbonization targets not just in CEE region but globally. Thus, the responsibility of banking sector lies also in financing green transformation of heavy industries. Although, projects focusing on the decarbonization of heavy industries and introduction of green technologies often fall somewhere in the “orange” area. The financing of the transition is usually outside of green bond scope.

This might be concluded as one of the main drawbacks of green bonds especially in CEE region. Industrial and agricultural core of these countries might limit the identification of purely green projects at the large scale. Concerns associated with greenwashing accusations can suppress the efforts to finance green transition. Especially in CEE region, a lot of sectors are only in the beginning of their transition journey, thus the identification of purely green projects as defined in green bond standards can be obstructed.

Alamgir and Cheng (2023) studied the role of green bonds in achieving sustainability, reducing carbon emissions, and increasing production of renewable energy. Different observations were made for green bonds issued before, and after 2015. This is likely affected by Paris Agreement signed in 2015. Green bonds issued before 2015 showed no significant effect on reduction of carbon emissions and renewable energy production. However, green bonds issued after 2015 showed significantly negative correlation between green bonds and carbon emissions, and positive correlation between green bonds and renewable energy. In terms of achieving the global Sustainability Development Goals, it was observed that countries with higher number of green bond issuances were more likely to achieve sustainability goals in comparison to countries with low number of green bond issuances.

Still there is no clear and conclusive answer whether the green bonds can be considered truly green bringing significant environmental benefit. Currently, there are several criteria considered to be market best practice and market standard for green bonds. All of them on the voluntary basis for issuer. The alignment of the green bond issuance with the green principles developed by ICMA is a prerequisite. Nowadays, it is generally accepted that credible green bond issuers in Europe follow ICMA Green Bond Principles, thus 4 core components are implemented to ensure transparency of green bonds: use of proceeds, project evaluation and selection process, management of proceeds and reporting. Majority of green bond frameworks developed by banks in CEE region is aligned with ICMA requirements such as Green Bond Principles, Social Bond Principles, Sustainability Bond Guidelines. Despite these facts, with thorough look at the data disclosed in publicly available green bond reports of investigated banks, the in-depth data analysis is missing. It is important to highlight that investments made into

eligible green projects as defined in green bond principles does not have to necessarily mean positive environmental outcome.

ICMA accompanied the Green bond principles with Harmonised Framework for Impact Reporting containing suggested impact indicators for each eligible green project category. There are several obstacles perceived while investigating green bond transparency and assessing the environmental impact. Firstly, eligible green project must meet at least one criterion out of suggested set in the GBP. In the prevalent green buildings category, it is usually the energy performance which is considered when approving project as green into green bond pool. Even though the energy efficiency is important, there are other factors which might potentially negate the positive impact of so-called “green building”. Factors such as building location, effect on biodiversity or carbon embedded in building materials are usually not evaluated, thus the complex picture about true environmental benefit of the building cannot be concluded with confidence. Secondly, aforementioned is closely related to impact reporting. It is predominant that green bond impact reports disclose only few out of the suggested impact metrics. For instance, for the green buildings, most reports show final/primary energy use or avoided GHG emissions per year. There is complete lack of information related to building materials, water use, waste management or effect on biodiversity.

Now, the green bond impact reporting is more about fulfilling market expectations than showing real environmental impact. The amount of avoided GHG emissions through the financed green project is important information, however without the context of other data, the greenness of the project can be questioned. Even energy efficient building built on the arable land is very hard to be considered green. There is also a question whether a plethora of green offices and shopping malls is bringing environmental benefit or if it is money-making project dressed as green.

Another important observation is that according to the current standards, green bonds can finance new green projects, however also re-financing is allowed. It can be discussed whether re-financing of already existing projects brings environmental benefit, hence these projects existed already before green bond, so there is no real contribution of the green bond towards green transition. At some

cases, the proportion of re-financing in the green bond pool can be prevalent or is not known. Then, the real question is where the money from investors really goes if the green bond pool contains already existing projects. Only answer to these questions is constant demand from stakeholders and pressure on green bond issuer to improve transparency and disclose more complex data. Of course, the collection of more granular data from customers represents a huge challenge for green bond issuer. However, to fulfill the true potential of green bonds, the increase of reporting granularity and more complex assessment of green projects is prerequisite. Herein, the pressure coming from regulatory frameworks demanding higher transparency from financial institutions and big companies can help to bring green bond to the next level.

Here, the expectations are set high in terms of the new EU Green bond standard. In 2022, the provisional agreement was reached on EU green bond standard, it is planned to become green bond gold standard. If the issuer would wish to issue green bond with EU label, the proceeds would have to be used to finance/re-finance EU taxonomy aligned projects. However, the evaluation of project alignment with EU taxonomy is so challenging for some issuers that the consideration of EU green bond label can be at the moment unreachable for prevalent amount of CEE green bond issuers. Herein, the simplification of EU taxonomy and higher usability of EU taxonomy might be beneficial to support issuers to align green bonds with EU GB standard.

5.3 Effect of Green Bond Issuance on Environmental Commitments

The fundamental question whether do green bonds bring clear environmental benefit strongly depends on the type of financed green project. Moreover, the environmental behaviour of green bond issuer plays significant role as well. Green bond issuer should not be performing the activities harmful to the environment such as financing of coal and fossil fuels. Thus, it is important to provide a broader picture when analyzing the green bond issuers. The climate commitments and public declaration of net-zero targets says a lot about overall attitude of green bond issuers towards green transition. Green bond issuers publicly declaring measurable climate targets are less prone to greenwashing concerns (Mazzacurati, 2021).

ESMA report (Mazzacurati, 2021) showed that energy firms, utilities and banks that issued a green bond between 2009 and 2019 were much more likely to disclose emissions data, and they have on average reduced their carbon intensity to a larger extent than other firms without climate-related commitments.

In this study, the complex analysis of green bond issuers in CEE region was accompanied by the investigation of their environmental commitments mostly focusing on the period after the first green bond issuance. It can be concluded that the overall perception and adaption of climate targets increased. There was no significant difference observed between bank with the first green bond already issued and banks with no green bond issuance. Therefore, climate targets set by banks might be the result of several actions including but not limited to green bond issuance, strengthening of regulatory obligations for large companies and increasing demand from investors. Majority of investigated banks is declaring climate targets at some level, however only part of them is quantitative and measurable. In this study, evaluation of bank green commitments was based on the analysis of available materials such as banks sustainability reports, business model, and strategy. The assessment can be challenging because of the inconsistency of disclosed data. Also, verification of methodology, data collection process, data quality and comparability are usually not possible. Herein, the implementation of EU taxonomy for uniform classification of green activities and mandatory non-financial reporting under the new Corporate Sustainability Reporting Directive can introduce common procedures and comparability among companies. In the end, investors will be benefiting from all these activities as well, hence it will provide them with an opportunity to base the decisions on the science-driven facts.

García et al. (2023) investigated the green bond pre-issuance and post-issuance characteristics of selected companies. The results showed that higher environmental score and lower CO₂ emissions production for companies issuing green bonds. Moreover, it was observed that these companies are more likely to focus on environment-friendly activities after the green bond issuance. On the other side, companies showing poorer environmental score are more likely to use CO₂ emissions offsetting projects to improve their overall performance without taking

actual climate action within company. Dan and Tiron-Tudor (2021) analyzed the green bond issuances in the European Union countries during the period 2014-2019. The study demonstrated direct correlation among the volume of green bond issuances, ESG ratings and ESG risk index. Higher ESG ratings tend to be associated with investors trust and confidence.

Investors decision-making process is affected by multiple factors, some of them are going beyond purely financial performance. Even investors without ESG preferences can be interested in diversification of the portfolio. Investors can benefit from greater transparency and at the same time can reduce the carbon footprint of a portfolio. This can become even more important with the upcoming Corporate Sustainability Reporting Directive introducing mandatory sustainability reporting (Rocher and Foussard, 2023). Moreover, shift to product-driven impact is observed. The focus is also dividing from the company own operation which is often considered a must at some level, to impactful products and services. Recently, biodiversity has caught investors interest, and exploring investment opportunities with the focus to restore and preserve biodiversity is in the spotlight (de Perlinghi, 2023).

Furthermore, the early adoption of climate goals within the business has a positive impact from the point of ESG risk management. The European Central Bank (ECB) developed a stress testing approach to measure the impact of climate change on companies, financial system, and households as well. The most important observation is that costs associated with early green transition will bring more benefits in the long-term horizon compared to the scenario when no transition happens. The ECB economy-wide climate stress test focused on the timing and ambition of transition towards net-zero, moreover analyzed the financial consequences of different scenarios for companies. Three scenarios have been developed, baseline scenario assuming no further action beyond already implemented policies, delayed transition scenario with temperature increase +2.6 °C and accelerated transition scenario with temperature at the 1.5 °C. Delayed transition would represent significant threat associated with increased physical risks such as floods or wildfires. The analysis of green investments needed for different transition scenarios showed that accelerated or late-push transition would require about €3 trillion investments by 2030 (FIGURE 11). Lower investments are

naturally associated with delayed transition, however the long-term physical risk associated with uncontrolled global warming will be much higher (de Guindos, 2023).

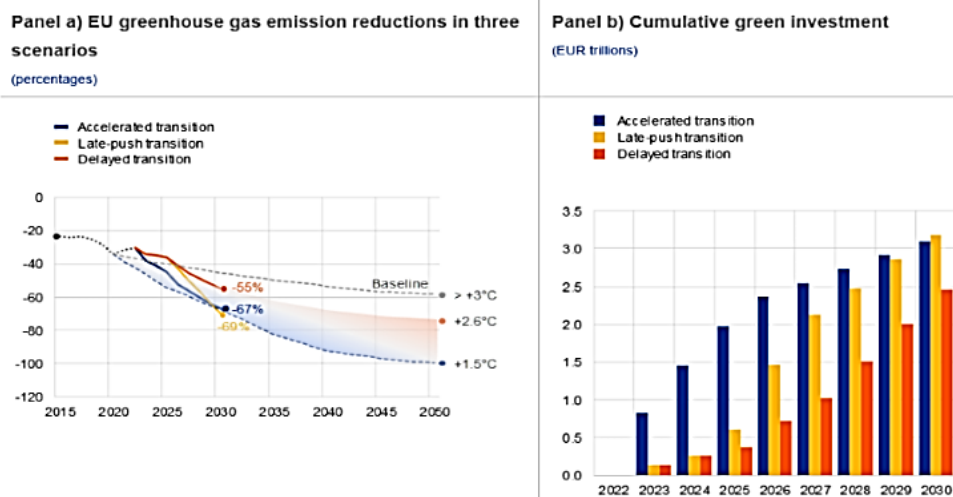


FIGURE 11. Emission pathways and green investment required in the three transition scenarios (accelerated, late-push, delayed). ECB calculation based on Orbis, Urgentem, Eurostat, NGFS and International Renewable Energy Agency (de Guindos, 2023).

6 CONCLUSIONS

Europe positions itself as a leader in decarbonization of the economy. In order for this to happen, a large amount of private investments is required. Financial tools such as green bonds channelling private capital towards green projects can significantly contribute to moving forward green transition. Herein, the focus is usually put on western European countries where the green financing is more developed in comparison to Central and Eastern European (CEE) region. The main reasons to centre research in the CEE region were a relatively undiscovered potential of green bond market in this region, and the necessity to speed up the green transition in the CEE region as well.

Banking sector plays a pivotal role in shaping money flow in the economy. Therefore, primary focus of the study was put on the banking sector in CEE region. The green bond market in CEE region is still in the beginning with some countries only starting their green bond journey. The presented study aimed to provide comprehensive view on the green bond issuances made by banking sector in CEE region. Green bond issuances have been discussed from the perspective of their environmental impact. Transparency of green bonds and possibility to determine the real environmental outcome of green financing has been discussed. Changes in environmental behaviour of the banking sector have been analysed.

The main findings of the thesis can be summarized as follows:

- Green bond market in the CEE region has been expanding, especially during the last 3 years, green bond issuances made by banking sector in the CEE region are in lower volumes comparing to the western Europe, however the increasing tendency is observed. The leading countries in the volume of issued green bonds are Poland and Hungary, followed by Slovakia, Czech Republic.
- Issued green bonds have been investigated from the perspective of environmental impact. The main question was whether it is possible to estimate environmental impact of issued green bonds. It was observed that proceeds raised from green bonds are mainly used to finance three eligible green project categories (as defined in ICMA

Green Bond Principles): green buildings, renewable energy, and clean transportation. On the one side, the buildings/construction, energy, and transportation sectors are among the main carbon emission producers in the analysed CEE countries, and the necessity to decarbonize these sectors is indisputable. On the other side, evaluation of green projects often lacks complexity. For instance, for building to be labelled as green, it is enough to meet energy performance requirements. However, information concerning building location, effect on biodiversity, water use, or waste management are usually not part of evaluation. It can be concluded that currently easy to meet criteria are prevalent which hampers transparency and questions real environmental impact.

- The data disclosed by banking sector about environmental impact of green bonds often lacks granularity. Based on the available data is hard for investors to formulate an opinion and compare the green bond issuers with each other.
- The drawback of green bonds in CEE region is insufficient financing of projects allowing green transition of hard to abate sectors. Especially because of industrial nature of CEE region, it is crucial to decarbonize heavy industries. These are usually in the beginning of green transition, thus are more eligible for transition financing which cannot be classified as purely green. Greenwashing concerns, and reputation risk may divert banks from financing transition activities. Thus, the main focus is put on the identification of purely green projects which can be challenging and can significantly limit the spectrum of eligible sectors. Consequently, hard to abate sectors might feel pressurized by regulators on the one side and overlooked by financial institutions on the other. This may lead to lack of motivation to invest into decarbonization.
- The changes in environmental commitments of selected banks with the first green bond already issued and without green bond issuance were investigated as well. Predominantly, the increasing trend

of setting up net-zero targets has been observed, however this is more likely to be a consequence of interplay among regulatory requirements, investors demand and the pursuit of competitive advantage.

Based on the observed conclusions, the recommendations can be stated:

- Stronger support of green agenda is required at the national governmental level in the CEE region. The narrative for green transition should be moved from burden to an opportunity. There is also responsibility lying on the financial institutions. Banks should strengthen the communication of the opportunities associated with green financing to the clients.
- To further support green transition, green technologies and decarbonization of hard to abate sectors should be financed on a larger scale.
- The regulatory frameworks, especially EU taxonomy for classification of green activities, should be simplified and more explanatory. Sometimes excessive concerns from greenwashing accusations can prevent banks from identification of eligible projects for green financing.
- Banking sector should prefer the communication of quantitative climate targets clearly stating how the net-zero goals will be achieved. Vague and general environmental statements should be prevented.

Banking sector can directly affect the green transition by choosing what kind of projects will be financed. The net-zero targets are clear message to public that the bank is planning to move out from fossil fuel business, thus they will not finance such projects. This is kind of pressure which might push industries towards investing into decarbonization. Together with supportive narrative and targeted advisory, the banks can decide how the profit will be generated.

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