

## FINANCIAL MARKETS FOR THE GREENER FUTURE: THE ROLE OF GREEN BONDS IN ENERGY TRANSITION. EVIDENCE FROM EUROPE

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**Purpose:** The aim of the article is to assess the role of the green bond market in financing investment activities in the field of energy transition. Attention was focused on the European green bond market, considered the most mature and developed market for assets of this class.

**Design/methodology/approach:** Critical analysis of domestic and foreign scientific achievements regarding the development and importance of the green bond market in the energy transition process. Analysis of secondary data from statistical reports showing the state of development and the degree of use of the green bond market in financing energy transition tasks in 2014-2022.

**Findings:** On the basis of the conducted research, it is concluded that the European green bond market is developing quite dynamically, and its structure is dominated by issues of green bonds intended to finance expenditures supporting the energy transition process.

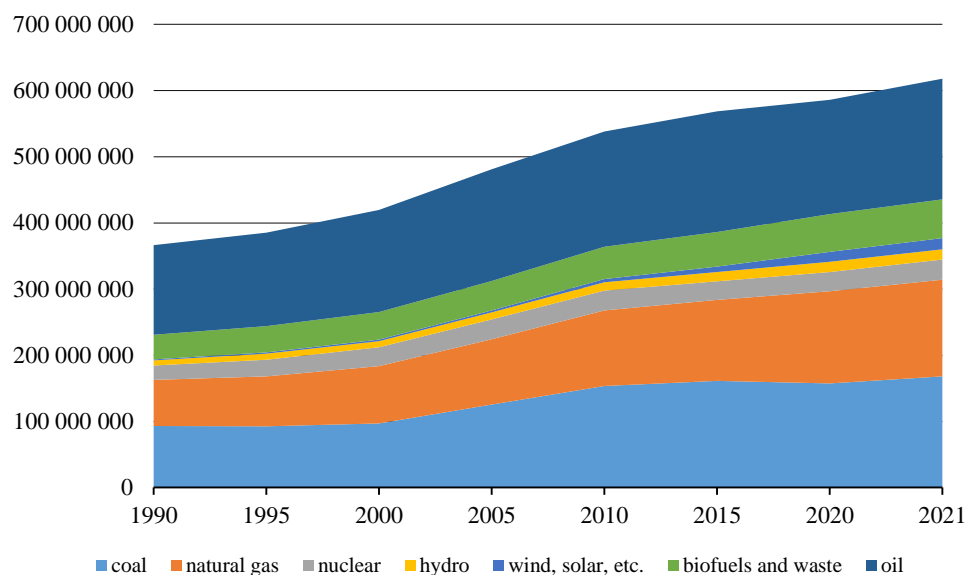
**Originality/value:** The green bond market - due to its relatively short history of operation, high dynamics of value growth and internal diversification process - is a relatively new object of research in economic sciences.

**Keywords:** green bonds, sustainable development, sustainable finance, energy transition, financial market.

**Category of the paper:** Research paper.

### 1. Introduction

With the progress of civilization and economic development, the demand for electricity increases. It is estimated that in 2022 global energy consumption increased by 2.5% (y/y), at a level similar to the average growth of the last decade (2.6% per year for 2010-2021) (Wiatros-Motyka, 2023). At the same time, over 80% of the world's energy supply comes from fossil fuels (Figure 1), the energy production sector is responsible for 40% of global carbon dioxide emissions, and fossil fuels for energy production generate two-thirds of global greenhouse gas emissions (Ayaz, Majeed, 2022).



**Figure 1.** Total energy supply by source in years 1990-2022 (in TJ).

Source: own study based on: <https://www.iea.org/>

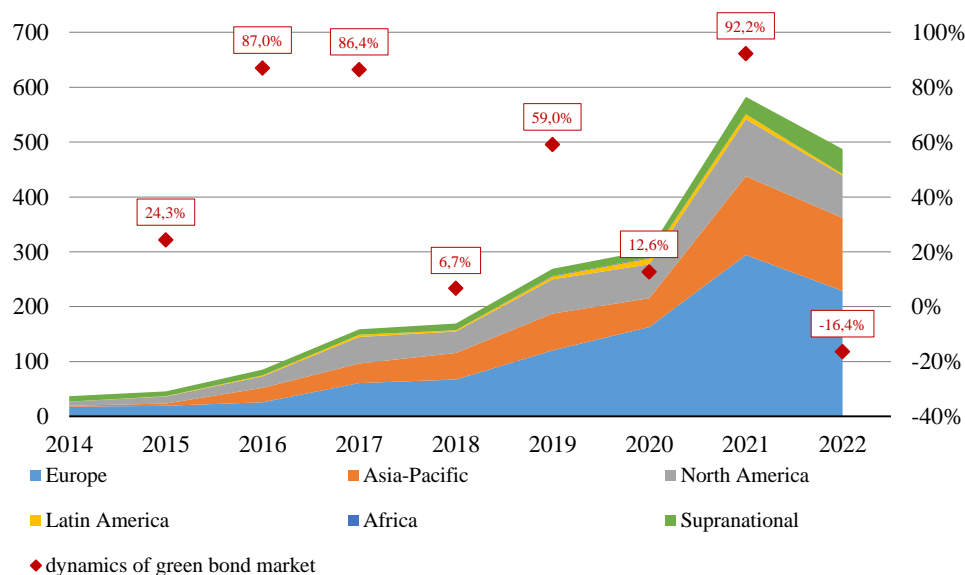
The high degree of dependence of the energy sector on fossil fuels (coal, oil and gas) and the resulting negative impact on climate change and the management of natural resources have made the transformation of current economic models towards systems focused on sustainable development and obtaining energy from renewable sources. not so much a need, but an imperative and challenge of modern times. The paradigm of contemporary energy policy clearly emphasizes the need to increase the role and importance of renewable energy sources, such as wind, water and sun. However, the development of these energy sources requires significant investment in research and development, infrastructure, and technology (Andersen, 2017). It is estimated that achieving the goals of the Paris Agreement (i.e., achieving net zero greenhouse gas emissions and limiting global warming to 1.5°C) will require global capital expenditures of \$4 billion per year by 2050 (Lorentz et al., 2023). Only in 2023, 500 billion was invested in the energy transition, and almost 70% of this amount came from private investors through the debt securities market. The above-mentioned situation illustrates the global trend of financing expenditure on energy transition - in the years 2018-2023, two-thirds of the value of investment expenditure allocated to energy transition investments came from the debt capital market (Saha, 2024).

In view of the above findings, the objective of the article was to assess the role of the green bond market in financing investment activities in the field of energy transition. Attention was focused on the European green bond market, considered the most mature and developed market for assets of this class.

## 2. Understanding the green bond phenomenon

One of the most important financial innovations in the area of sustainable finance over the last ten years has been the development of the market for green bonds and other labelled debt instruments (e.g. social bonds, sustainable bonds or green securitisation). The financial structure of these instruments does not differ from plain-vanilla bonds, except that green bonds contain a clause to use the proceeds from debt issuance to finance (or refinance) projects related to broadly understood pro-ecological activities. This means that, unlike classic debt instruments that supply the issuer's general capital, green bonds finance projects consistent with sustainable development goals. However, the financial risk of these instruments is secured by the general economic situation of the issuer - the bond buyer is not directly exposed to the financial risk related to specific projects that finance green bonds (Maltais, Nykvist, 2020).

The year 2007 is generally considered to be the beginning of the green bond market, when the European Investment Bank issued the first Climate Awareness Bonds (CABs). The value of the green bond issue was \$0.9 billion and its aim was to raise capital that would form the basis for loan financing for investment projects in the field of renewable energy sources (wind, water, solar, geothermal) and improve energy efficiency (district heating, cogeneration, building insulation, reducing energy losses in distribution networks) (Cortellini, Panetta, 2021; Pawłowski, 2017). Although after more than 15 years of operation, the market for these instruments constitutes slightly more than 1% of the global bond market (Chasan, 2019), it shows above-average value growth and is successively expanding the spectrum of listed instruments and green debt (Figure 2).



**Figure 2.** Volume of green bond issuance by region (left axis; in \$billions) and dynamics of green bond issuance (right axis) in 2014-2022.

Source: Own study based on: <https://www.climatebonds.net/>

The green bond market is seen as a catalyst for the metamorphosis of economic systems toward a resource-efficient and low-emission economy. The green bond market is therefore within the scope of perception of national governments, supranational institutions and organizations supporting the development of financial markets, because only a well-developed and properly functioning green bond market will constitute a source of financing for pro-ecological investments that is complementary to public funds. It is worth mentioning that Europe is not only the cradle for the development of the green bond market, but also an area where numerous initiatives and activities are undertaken aimed at the development of this segment of the financial market.

The presentation in 2014 can be considered a milestone in the development of the green bond market. Green Bond Principles (GBP) by the International Capital Market Association (ICMA). This document was the first internationally recognised standard to unify the rules for the issuance of green bonds and introduce good practices to promote and support the further development of the market for these instruments. Experience shows that the introduction of GBP has led to greater market integrity and set a global standard for the definition of green bonds. In addition, the document established an issuance framework (based on transparency, pre-issuance disclosure, post-issuance reporting, third-party verification) to help investors assess the environmental performance of climate bonds and the credibility of issuers. Moreover, GBP has also become the basis for subsequent methodological approaches to standardize and classify forms of green debt (Ehlers, Packer, 2017).

It is also worth mentioning that in Europe in 2010 One of the first institutions monitoring the development of the green bond market was established - Climate Bonds Initiative (CBI). This institution focusses its activities on providing broadly understood tools supporting the development of debt financial instruments dedicated to financing activities consistent with the goals of sustainable development. CBI not only monitors and reports data on the size of the green bond market, but also provides recommendations on green bond issuance standards, provides advisory services on green debt issuance, and formulates proposals for policy models supporting the future development of the green bond market. Importantly, CBI's activities are not only highly diversified in terms of subject matter, but also geographically - with the development of CBI's activities, the scope of its research covered basically all economies in the world.

**Table 1.**

*The structure of the global green bond market by the county as a % of total volume in 2014-2022*

	2014	2015	2016	2017	2018	2019	2020	2021	2022
<b>Europe</b>	48,9%	43,1%	30,4%	38,2%	39,7%	44,7%	53,8%	50,5%	46,9%
<b>Asia-Pacific</b>	4,4%	7,9%	31,1%	22,4%	28,7%	24,9%	17,4%	24,6%	27,4%
<b>North America</b>	20,2%	28,1%	24,4%	30,7%	23,0%	23,3%	20,3%	17,8%	15,7%
<b>Supranational</b>	25,7%	18,5%	12,0%	6,0%	7,2%	4,9%	4,6%	5,4%	9,3%
<b>Latin America</b>	0,5%	2,4%	1,9%	2,5%	1,3%	1,9%	3,6%	1,6%	0,6%
<b>Africa</b>	0,3%	0,0%	0,2%	0,2%	0,1%	0,3%	0,3%	0,1%	0,1%

Source: Own study based on: <https://www.climatebonds.net/>

Referring the previous observations to scientific research, which shows that among the many factors influencing the development of the green bond market, the most important are market infrastructure, legal regulations, and the economic situation (Tu, 2020), one can find a justification for the dominance of the European green bond market in the structure of the global market for these instruments (Table 1.). Analysis of the structure of the global green bond market indicates that basically half of the global value of green debt is issued on the European continent. Therefore, the European green bond market can be considered a more mature market structure, and further analysis will be devoted to this part of the global green debt.

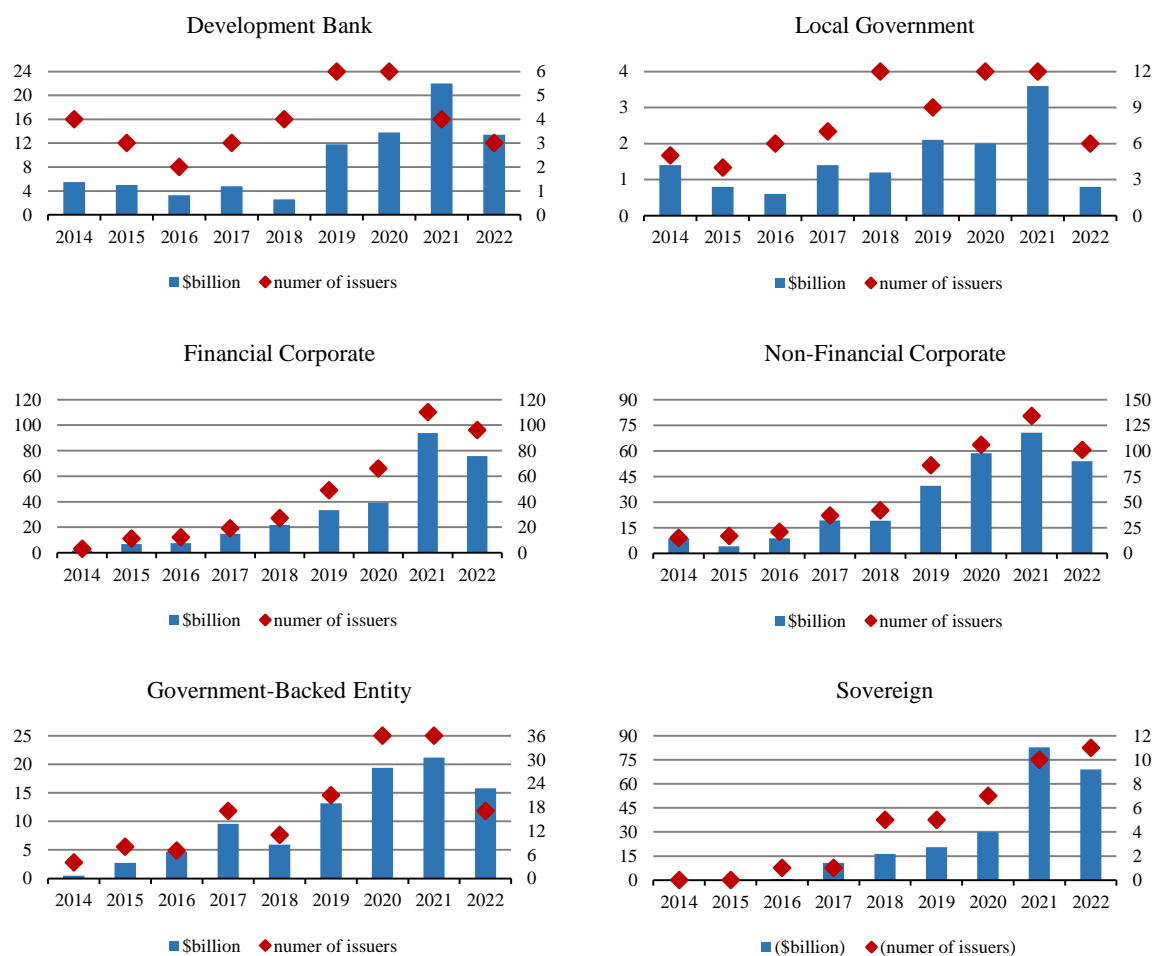
### **3. Energy Transition as a Beneficiary of the European green bond market**

The global dissemination of the concept of sustainable development and the building of a new paradigm of economic development on its foundations give the contemporary understanding of climate risk a dual character. In the first (typical) approach, climate risk refers to the interaction of climate-related threats with the enterprise's operations (in the physical aspect), resulting in losses in the enterprise's assets or disruptions in the proper functioning of supply chains. The second dimension of climate risk results from changes in policy, technology, social pressure, or investor expectations regarding a business model adapted to a low-emission economy and concerns losses arising as a consequence of reputational risk (Tuhkanen, Vulturius, 2022).

Regardless of the source of materialisation, climate risk, in its essence, leads to the variability of a company's operating profits and changes in its market position, so there is a growing awareness of the importance of climate risk in the activities of modern organisations. The issuance of green bonds can therefore be perceived as a corporate response to the need to manage climate risk (in each of the discussed aspects), as well as as a way of communicating with the market (declaration of undertaking activities aimed at reducing the carbon footprint of the business).

The above highlights the economic importance of the green bond market and is one of the foundations of the dynamic growth of its value. However, apart from quantitative criteria, the green bond market is also characterized by qualitative changes. The first is the type of diversification of entities issuing green debt (Figure 3). The findings so far show that the green bond market was initiated by issues made by supranational financial institutions. This brought lasting consequences for the subjective structure of issuers present in this market, because until 2013 the green bond market was created by issues of supranational financial institutions with a small share of issuers representing local governments. We have been watching the process of diversification of the group of issuers involved in the issuance of green bonds since 2014,

and it should be emphasised that the differentiation of the market's entity structure is quite clear (Pawłowski, 2018). It turns out that in the analysed period, the importance of supranational financial institutions in shaping the value of the green bond market decreased dramatically (from 95% in 2012 to 1.3% in 2022). At the same time, based on the statistics presented, three main categories of issuers can be distinguished, which can be attributed a significant share in shaping the value of the green bond market - financial corporate, sovereign and non-financial corporate (respectively responsible for 33%, 30% and 24% of the value of the green bond market in 2022). A decrease in emission activity in 2022 should be noted. within each issuer group (for the entire green bond market, the value growth rate for 2022 = -16.4%). The above is a consequence of inflation, which causes the collapse of the fixed income market (CBI, 2024).



**Figure 3.** Green bond issuance volume by the issuer type (left axis; in \$billions) and number of issuers by the issuer type in years 2014-2022 (right axis).

Source: Own study based on: <https://www.climatebonds.net/>

As the structure of issuers making up the green bond market changes, the types of pro-ecological activities financed through it change. The analysis of the green debt market through the prism of the direction of use of proceeds from the issuance of green bonds indicates the dominance of investment tasks in the field of energy transition (Figure 4). Since 2014, the energy sector has received proceeds from the issuance of green debt, and green bonds issued

to finance this type of expenditure represent the largest part of the debt. Although the share of green bonds intended to finance pro-ecological energy projects decreased from 63% in 2014. up to 34% in 2022, however, this segment of the green bond market is gradually gaining in importance and value (the average growth rate of the value of green bonds intended to finance expenditures in the energy sector in 2014-2022 is 33% annually).

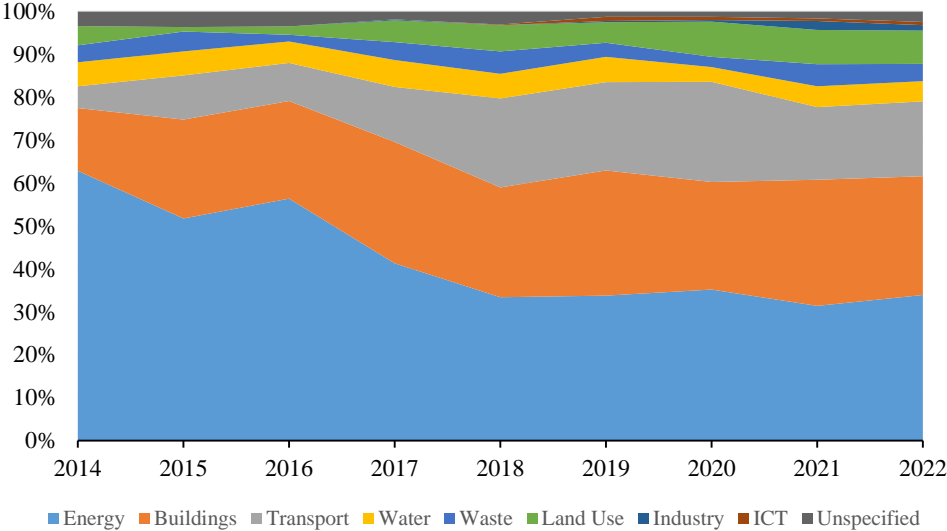


Figure 4. The structure of the Green Bond Market by the use of proceeds in years 2014-2022.

Source: Own study based on: <https://www.climatebonds.net/>

It is also worth noting that in the years 2014-2022 the energy sector is responsible for the largest value of green bond issues. Their total value is \$350 billion (Figure 5).

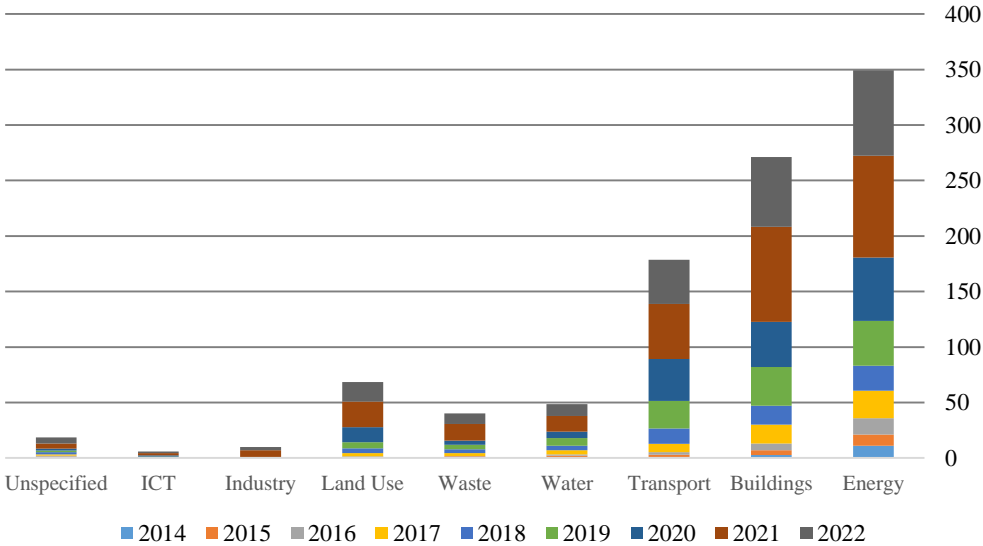


Figure 5. Total value of green bond issues by use of proceeds in years 2014-2022.

Source: Own study based on: <https://www.climatebonds.net/>

## 4. Conclusions

Commitments by governments and the private sector to ambitious emissions reduction goals and the transformation towards a resource-efficient economy make the green bond market increasingly important and characterized by above-average dynamics of value growth. The implementation of the concept of sustainable development requires significant investment in technical infrastructure, assets, and R&D. In this respect, public funds turn out to be insufficient, thus creating the need for private capital to participate in financing pro-ecological investments.

The green bond market fills the capital gap in financing tasks covered by the Sustainable Development Goals. From the point of view of the problem of energy transition, issuers' motivations for financing through the issuance of green debt may focus on the desire to diversify the investor base and access to a greater value of capital not limited by the capabilities of a single investor (as opposed to the banking sector) and/or use the green debt market to communicate with market (as an instrument signaling commitment to environmental protection activities, with all the benefits that result from it).

Regardless of the reasons for the issuance of green bonds, the analyses discussed in this article have shown that the energy sector is the largest beneficiary of the green bond market. The scale and value of the bonds issued to finance energy transition tasks clearly dominate the structure of the green bond market. Moreover, there is a progressive diversification of the group of green debt issuers, which only emphasizes the role and importance of the green bond market in the accumulation of capital for activities aimed at environmental protection.

It can be assumed that the scale of needs related to the energy transition and the development of alternative energy sources will only fuel the further development of the green bond market, both in quantitative and qualitative terms. However, for the green bond market to play its role in the energy transition process, further in-depth research is needed, including: premises determining the choice of the green bond market as a source of financing expenditures intended for the energy transition process, or even the issue of the effectiveness of financing these expenditures through the issuance of green debt.



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