



# Are green covered bond impact reports reliable?

Zsolt Mihalovits  
Hungarian Central Bank  
Budapest, Hungary  
[mivalovitszs@mnbb.hu](mailto:mivalovitszs@mnbb.hu)

Eva Paulik  
Hungarian Central Bank  
Budapest, Hungary  
[paulike@mnbb.hu](mailto:paulike@mnbb.hu)

## Abstract

This study aims to provide an overview of the current impact assessment methodologies of green covered bonds using residential and commercial real estate collateral based on a few recent examples in Germany, Poland and Hungary. The study recalls the various impact recommendations and provides an insight into what is currently included in impact assessments. It also reviews the methodology and some data sources used by impact assessment providers. Green covered bonds are still a very young asset class but as it has grown, so has investor interest in impact reporting to inform decision-making processes, analysis and investor reporting. At the same time, impact reports still show significant variability and very different levels of transparency. In addition, this paper highlights some of the missing links and data in the environmental impact assessment of real estate backed bonds in general.

## Keywords

Green covered bond, Impact report, Green building, Green finance, Sustainability

## 1. Introduction

Estimating the environmental impact of green bonds is crucial for the transparency of the market and for supporting investment decisions. Impact reporting in general is at a relatively early stage in its development due to the lack of data, standards and methodologies. Compared to green bonds in general where the use of proceeds can vary more widely, in this paper the focus was on green covered bonds that finance green real estate. This narrower market segment with fairly homogeneous cover pools (mainly residential properties) offers a good opportunity to observe how the environmental impacts are assessed, what type of data sources and methodologies are used by the different providers, and what type of data gaps exist depending on the issuer and jurisdiction.

Our motivation is twofold: on the one hand, the Central Bank of Hungary invests part of its reserves in green bonds (also via a dedicated green bond portfolio); therefore, has a vested interest in having access to more transparent, comparable and reliable impact reports. On the other hand, the Central Bank as a regulator has already taken several steps to jump start the domestic green covered bond market.

Therefore, this article could be of interest both to investment professionals and regulators who would like to get an overview of how green covered bond impact assessments are carried out at this current, relatively initial stage of development.

## 2. Short overview of green covered bonds and impact reports

Green covered bonds are the tools to finance low carbon infrastructure (mainly residential property), which are largely collateralized against green mortgages that help borrowers buy a sustainable building or renovate an existing one to make it greener. By issuing green covered bonds, banks will be able to access cheaper and longer-dated funds to on-lend to designated low carbon projects. At the same time, highly regulated institutional investors will be able to increase the exposure of their portfolios to low carbon, highly rated assets because of the high level of security offered by covered bonds (CBI, 2017a). Moreover, a greener building stock can play a key role in reducing both greenhouse gas (GHG) emissions and energy consumption. Both have become paramount given the extreme weather events, the geopolitical and subsequent energy market developments in 2022. In Europe, almost every major covered bond issuer has already launched green covered bonds. Moreover, several have already announced plans to gradually shift away from brown lending and towards more green lending.



The purpose of the impact report is to quantify the climate or environmental impact of a project or an asset. This level of reporting is gaining prominence in green markets, and helps investors measure positive externalities through their investments. The objective is to quantify changes in the climate performance of an asset, a project, or a portfolio with respect to relevant indicators. Disclosure of impacts has become more common over the last few years, and there are now more resources and guidance covering this aspect of reporting. The cornerstones of the credibility of the impact report are continuous measurement, the reliability of the data, their regular publication and incorporation into the company's reporting structure.

The Climate Bond Initiative was the first to develop its taxonomy to identify the tools, activities and projects needed to achieve a low-carbon economy in line with the goals of the Paris Agreement. The two other key initiatives that can most clearly be considered impact reporting methodologies are ICMA Green Bond Principles and the Nordic Position Paper.

The expansion of reporting since the market's inception is positive, which has given rise to a breadth of metrics and approaches, but it also raises some concerns, particularly around standards and consistency. Current green bond impact reporting „standards“ are only recommendations, as they are voluntary and are also quite heterogeneous. Impact report calculation methodologies and data sources are often not public, and they mostly focus on GHG impact and metrics.

While the quality of impact assessment reports can vary a lot, in principle their benefit is that the transparency over underlying covered pools will enable analysts to better track the financial performance of low carbon assets and compare them to their higher carbon alternatives, improving the level of information available to fund the transition to a low carbon economy.

### **3. Industry recommendations for green covered bonds vs. what is usually included**

There are only industry recommendations but no regulation on what should be included in the impact assessment. We consider the 1) Nordic Position Paper (NPSI) and the 2) International Capital Market Association (ICMA) Green Bond Principles (GBP) Working Group recommendations. What is included is covered in 3) the Climate Bond Initiative's study on post-issuance reporting.

The EU green bond standard is also on its way following its long implementation period. Originally, the standard was intended to complement and co-exist with existing, voluntary market-based standards and principles, most notably, the ICMA Green Bond Principles, which most existing green bond issuances are aligned with (ICMA, 2022). However, there are now plans for making the EU GBS designation mandatory for all bonds marketed as environmentally sustainable between 2025 and 2028. Nonetheless, with respect to buildings, the EU Taxonomy's technical screening criteria are not more ambitious than current industrial practices in Germany and Poland: at least 10% below the primary energy demand (PED) of Net Zero Energy Buildings (Drees & Sommer, 2022a; 2022b). Therefore, even if they become mandatory sometime between 2025 and 2028, they would not likely have a significant impact.

In its recommendations of what to include in the impact assessment of a green covered bond, the Nordic Position Paper (NPSI) primarily focuses on the energy performance of the buildings. Impact assessment should disclose energy savings from green buildings as a net value compared to national building requirements. Alternatively, performance can be reported in comparison to a relevant reference building. Refurbishments and retrofits are to be compared against status pre-investment. Recent green covered bond impact assessment reports mostly adhere to these recommendations and focus primarily on the energy performance of the buildings, and not really offering any information beyond that.

In addition to the information about the energy performance of a building, the NPSI also encourages issuers to describe other environmentally relevant features of the building, if feasible. This information may include the main material groups used in the construction, the location of the building, water intensity, waste management, any use of fossil-free construction machinery and equipment, waste management policies on the construction site, mitigation efforts related to physical climate risks, etc. However, issuers are not required to calculate CO<sub>2</sub> impact of building materials as these emissions are outside scopes 1 and 2<sup>1</sup> (NPSI, 2020).

The GBP Impact Reporting Working Group lists several more metrics for green building projects that also go beyond the usual energy and carbon performance metrics, such as, metrics related to water efficiency, water savings and waste

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<sup>1</sup> Scope 1 emissions are direct emissions from owned or controlled sources. Scope 2 emissions are indirect emissions from the generation of purchased energy.



management. In addition to the usual scope 1 and 2 type emissions, their recommendations go beyond the operational aspect of buildings and list scope 3 metrics, such as the potential use of materials with lower environmental footprint, the land use and biodiversity aspect for new buildings or other qualitative aspects that benefit the users of the buildings, such as indoor air quality, light quality, or transport connectivity. Some of these latter measures are often taken into account by sustainability certificates for commercial buildings, but not for residential buildings (ICMA, 2019).

The Climate Bonds Initiative's third study of post-issuance reporting in the green bond market, which also assesses green bonds that finance buildings, concludes that impact reporting in the commercial building sector is often in the form of building certifications achieved. Several certification programs were highlighted by issuers, the most common being BREEAM and LEED, and there are also some regional variations. Overall, building certifications are considered useful; but given the inconsistency in levels, performance criteria and thresholds between different schemes, CBI highly encourages issuers to disclose impact data where possible, ideally of actual performance in the form of industry benchmarks, such as an intensity (e.g. per m<sup>2</sup>) and also include relative (i.e. %) improvements. Their conclusions are that the share of issuers reporting building certifications is higher than by amount issued, perhaps due to larger issuers having more resources to disclose direct data on environmental performance alongside, or instead of, certifications. Overall, the most common metrics are overwhelmingly those related to GHG, energy and CO<sub>2</sub> savings, followed by energy. Other metrics related to water use, waste, recycling rate of construction materials used etc. only appear in a handful of impact reports, as evidenced by the chart below (CBI, 2021).

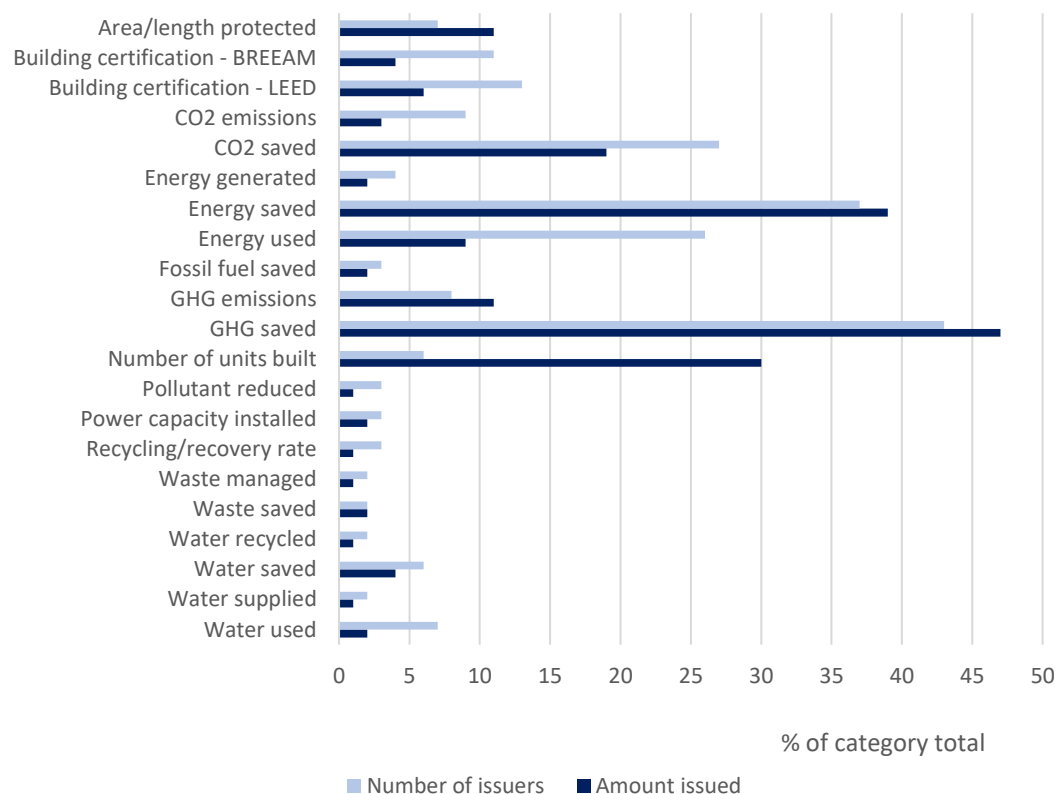


Figure 1. Metrics used in covered bond impact reports  
(Source: Climate Bonds Initiative, 2021)

#### 4. Impact assessments in practice

Green bonds are still a relatively new asset class, green bond frameworks and environmental impact assessments have only started a few years ago, with the first green covered bond (Pfandbrief) issuance in 2016 in Germany, 2019 in Poland and 2021 in Hungary with the very first impact reports just out recently.

The rationale behind impact assessments is that the financing and/or ownership of commercial and residential buildings with low energy demands avoid greenhouse gas emissions, that would otherwise have been emitted from less energy efficient buildings used for the same purpose. This is of course a point that could be argued. While the impact of a renovation project can be quite straightforward green covered bonds to a large extent finance the construction and purchase of new buildings. Where the positive environmental impact is not as obvious as these new buildings often do



not necessarily replace older, less efficient buildings and because the construction activity itself also leads to GHG emissions. When considering the environmental impact of buildings, the most often used functional unit is avoided tons CO<sub>2</sub>-equivalents (or CO<sub>2</sub>e) of greenhouse gases<sup>2</sup> per building and share of financing (1% to 100%). As a normalized unit of comparison, tons CO<sub>2</sub>-equivalents (or CO<sub>2</sub>e) per million € (EUR m) financed are calculated as well. This is one of the specific green bond metrics often used by investment professionals and is an additional investment metric in addition to the traditional risk, yield etc. metrics. In fact, a green asset manager striving to make the biggest environmental impact per invested capital could rank potential investment based on the avoided tons per million euro invested.

#### 4.1. Overview of the basic GHG impact calculation methodology

The calculation of avoided emissions for commercial and residential buildings follows a logic similar to the above mentioned one, and requires 5 crucial data inputs based on the impact assessment reports reviewed for this paper<sup>3</sup> (see formula below). The potentially avoided GHG emissions are estimated by taking the difference between 1) energy requirements of the building stock (benchmark value) per square meter, and the 2) energy requirements of the financed green building per square meter. In the case of a renovation, this is of course easier: the final energy demand of the two states (i.e. before and after renovation) are compared. The energy saved by buildings in kWh/m<sup>2</sup>a is then multiplied by a factor specific to each market (country) that takes into account the amount of GHG or more simply CO<sub>2</sub>-equivalent emissions required to generate one kilowatt-hour of energy for the building. This is called 3) *country-specific carbon intensity*. Finally, 4) the annual carbon emission savings per square meter are multiplied by the total floor space of the building to determine the building's total emission savings per year. It may be the case that a financial institution only finances part of the building. Then the green building's total emission savings are also calculated as a ratio of financing volume. 5) The final step is to divide the emission savings attributable to the volume of the loan, giving emission savings per EUR 1 million of financing.

$$\frac{1. \quad \left[ \text{benchmark} \left( \frac{kWh}{m^2a} \right) - \text{energy consumption} \left( \frac{kWh}{m^2a} \right) \right] \times 2. \quad \text{country-specific carbon intensities} \left( \frac{kg \ CO_2}{kWh} \right) \times 3. \quad \text{building area} (m^2) \times 4. \quad \text{financing share} (\%)}{5. \quad \text{loan volume} (\text{€ mn})}$$

Figure 2. The calculation methodology for the avoided GHG emissions/invested amount of a green building  
(Source: NORD/LB, 2021 )

#### 4.2. Benchmark –PED for heating the building stock

One of the most important implicit assumptions behind all impact assessments is that the financed green building would replace an old, less efficient building from an operational standpoint and thus would lead to energy and GHG savings.

Energy savings of green buildings are compared to the existing building stock. There are two main approaches to calculate the PED of the theoretically replaced building and the energy savings arising from the replacement.

- One approach tries to match the type of new building with the type of the old building and use those theoretical PED numbers. This is a granular method which requires a lot of data and assumptions. One often used data source is the Tabula-Projekt.<sup>4</sup> It is a study which 'constructed' several generic building types and sub-types in several EU countries, based on a given construction period and the available data on energy demand. As a result, this data set provides typical final and primary energy demands for different residential building types and construction periods. In principle, each residential building of a national stock can be replaced by a generic building type of the national building type matrix. The financed buildings are then matched with the reference buildings that are sufficiently comparable. Out of the impact assessments analyzed for this study, the Wuppertal Institute mentioned using this methodology (Wuppertal Institute, 2022).
- A less granular approach uses the theoretical weighted average efficiency numbers of the national residential building stock for comparison. This type of data is also not readily available in all cases and needs to be calculated/estimated using various data sources, studies, using building occupancy types, periods of construction, residential energy performance building

<sup>2</sup> Wuppertal Institute (2022), The global warming potential of Greenhouse gases refers to 100 years (GWP 100a) and is calculated with the help of characterization factors for Kyoto-Gases by the IPCC (AR5). This rationale is in line with current market practices as suggested by the ICMA Green Bond Principles as well as Harmonized Framework for Impact Reporting (ICMA, 2022).

<sup>3</sup> Based on: Drees & Sommer (2022a; 2022b), MünchenerHyp (2021), NORD/LB (2021), Wuppertal Institute (2022).

<sup>4</sup> <https://webtool.building-typology.eu/#bm>



codes that were applicable over the years, and finally considering any kind of statistics, often estimations thermo-modernization works done over the years. Based on such a data analysis, it is possible to estimate the building stock's primary energy demand. The result of such an exercise is shown below as an example.

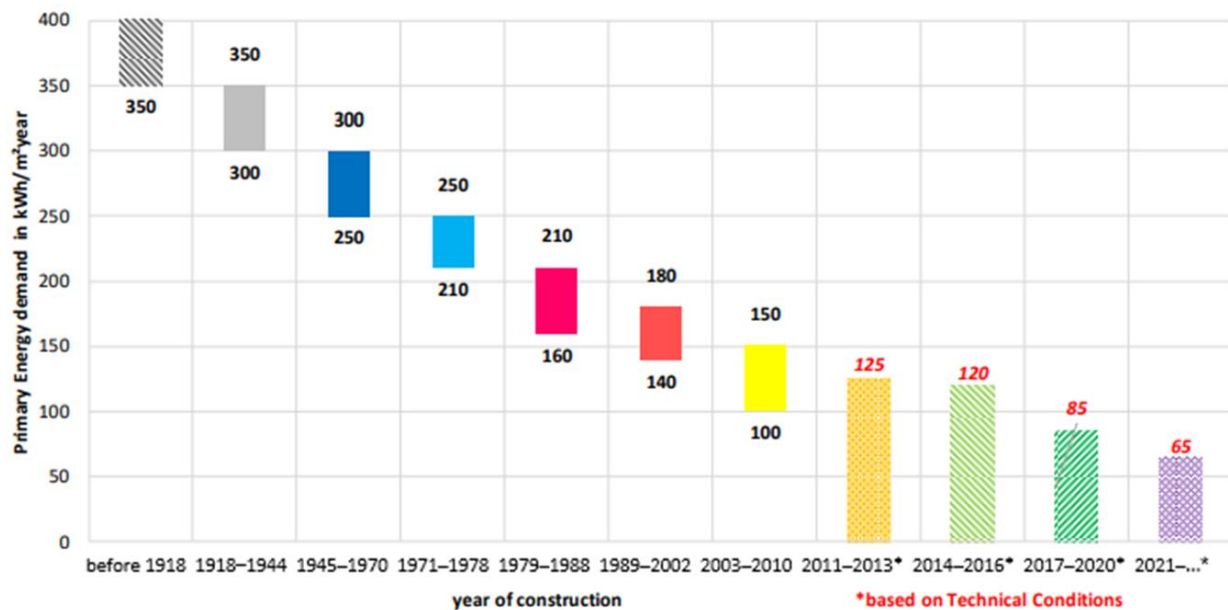


Figure 3. Poland's residential building stock - primary energy demand by year of construction and technical conditions  
(Source: Drees & Sommer, 2022a)

Applying the number of buildings for each year of construction and the mean primary energy demand for the respective Polish building codes, a weighted average PED for the national residential building stock can be estimated. (These are the higher numbers in Figure 3). Furthermore, by including an estimate for any potential thermo-modernizations, the primary energy demand of the building stock is estimated<sup>5</sup> (the lower numbers in Figure 3). For Hungary, a similar survey of the building stock was carried out in 2013, also estimating the PED of the 15 building types in their original states at the time of construction (Nemzeti Épületenergetikai Stratégia – NFM, 2015). However, there is no available information on the thermo-modernizations over the years and what the actual weighted average PED of the building stock is currently. There are plans to conduct a fresh survey of the building stock that would provide the possibility to follow any thermo-modernizations carried out over the past decades. The impact assessments we have reviewed did not use residential building stock data. One of the recent impact reports circumvents this question by using two collateral pools: one cover pool consists of green buildings, the other of conventional ones, the PED of both is estimated and the difference is treated as avoided emissions (OTP, 2021).

#### 4.3. Energy consumption - PED of financed green building

Assets that are considered eligible to be included in green covered pools are green mortgage loans used for the acquisition, construction, or refurbishment of green buildings. There are also covered bonds backed by assets other than residential or commercial buildings, e.g. renewable energy power plants, ships etc. These are not covered here. The document governing green covered bond issuance is the green bond framework. A framework is set up by the issuer, while adherence to the framework is certified by external providers in what is called a *second-party opinion* (SPO), which provides investors with assurance that the bond framework is aligned to accepted market principles (ISS ESG, 2022). The issuers set up internal teams sometimes called Green Bond, Asset or Building Commission that are responsible for defining Green Bond Minimum Standards and ensure that the minimum standards required in the target markets are complied with. In the context of green bonds, the term *green building* is closely linked to energy efficiency. In December 2018, the Energy Efficient Mortgages Initiative (EEMI), led by the European Mortgage Federation and the European Covered Bond Council, published a first definition of *energy efficient mortgages*. It stipulates that if renovations lead to

<sup>5</sup> Calculated by Drees & Sommer (Best estimate is the full length of the bar charts above). In this example the estimate weighted average PED for Poland's building stock the so called benchmark is 210.6 kWh/m²/year for the year 2019.



a decrease in energy demand or consumption of at least 30% for the mortgage loan financing, this renovation must be considered energy efficient. In summer 2019, the Association of German Pfandbrief Banks (vdp) member banks agreed on a common minimum standard that includes different approaches and gives certainty to green covered bond investors concerning what they can expect when they invest in a green German covered bond (Pfandbrief), independently of the issuer. Commercial and residential properties can be eligible by meeting at least one of several other criteria (Sustainabonds, 2019). For example: commercial properties whose sustainability certificates are ranked in an established provider's top categories; residential properties assigned to energy class B or better, or with energy demand no greater than 75kWh/m<sup>2</sup>. Renovations or refurbishments resulting in a reduction in energy consumption or demand of at least 30% are also eligible or buildings that are in the top 15% of the national stock regarding energy consumption/demand – in line with the Climate Bonds Initiative (CBI) and the EU Taxonomy. The Climate Bond Initiative (CBI) definition of low carbon buildings only accepts the 15% with the lowest carbon intensities in a regional market. City-baselines developed by the CBI are trajectories that also include the term of a green bond financing green buildings (CBI, 2020). The longer the term of the bond, the lower is the maximum allowed carbon intensity. This approach aims to ensure that a green, energy efficient building represents the top 15% in its local market at least until the maturity date of the bond. Although these criteria and minimum standards are important steps to increase the harmonization of green building definitions, they still leave room for different approaches and qualities.

Table 1. Common minimum standards for green buildings in Germany  
(Source: *Environmental Finance*, 2020)

| COMMERCIAL REAL ESTATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | RESIDENTIAL REAL ESTATE                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>New construction financing:</b> <ul style="list-style-type: none"> <li>– At least the statutory energy standards for new buildings at the time of financing</li> </ul>                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Acquisition of existing properties:</b> <ul style="list-style-type: none"> <li>– Compliance with comparative values published by the German Federal Ministries for Economic Affairs and Energy, and for the Environment, Nature Conservation, Building and Nuclear Safety on 7 April 2015, or</li> <li>– Sustainability certification top category (LEED, BREEAM, DGNB, etc.), or</li> <li>– Top 15% of national commercial property stock with regard to energy consumption/demand</li> </ul> | <b>New construction/acquisition of existing properties:</b> <ul style="list-style-type: none"> <li>– Energy efficiency class B or better, or</li> <li>– Energy demand no greater than 75kWh/m<sup>2</sup> or,</li> <li>– Projects co-financed by KfW funding programs for energy efficient construction or renovation, or</li> <li>– Top 15% of national residential property stock with regard to energy consumption/demand</li> </ul> |
| <b>Renovation/refurbishment:</b> <ul style="list-style-type: none"> <li>– Reduction in energy demand/consumption of at least 30% and</li> <li>– New energy demand/consumption in line with EU climate objectives</li> </ul>                                                                                                                                                                                                                                                                       | <b>Renovation/refurbishment:</b> <ul style="list-style-type: none"> <li>– Reduction in energy demand/consumption of at least 30%, and</li> <li>– New energy demand/consumption in line with EU climate objectives</li> </ul>                                                                                                                                                                                                            |

An asset is categorized as a Green Building if the applicable standards are fulfilled at the time of inclusion in the Green Bond portfolio. The primary energy demand or consumption (warmth) should be used for valuation if the use of renewable energy reduces the primary energy demand or consumption to below the final energy figure. In the case of commercial buildings, compliance with the thresholds is proven by energy performance certificates (EPC) which the bank asks its borrowers to provide as an integral part of the loan origination process. In addition, the bank asks its customers for sustainability certificates issued by known institutions, such as LEED, BREEAM, DGNB and HQE. In order to be eligible for the green finance portfolio, these have to reach a certain minimum (NordLB, 2021). In target markets outside Germany, issuers already follow the CBI top 15% rule of the national building stock. The identification is based on the



primary energy demand. Another possibility is if the building is already a “Nearly-Zero-Energy-Building”, as a standard for all new buildings is compulsory since 2021, for public buildings already since 2019. This standard describes a building that has a very high energy performance. Near-zero or very low energy demand should be met to a very significant extent (min. 25%) by energy from renewable sources, including energy from renewable sources produced on-site or nearby (European Commission, 2010). For the financed „green” buildings, maximum primary energy demand metrics are derived by considering all of the green building definitions above by Green Bond, Asset or Building Commission at each issuer. These serve as performance limits (maximum values) for financing both commercial and residual buildings. For example, for German green residential buildings, depending on the year and the bank, a maximum primary energy demand of between 55–75 kWh/ m<sup>2</sup>/year has been used lately as defined by several issuer’s framework.

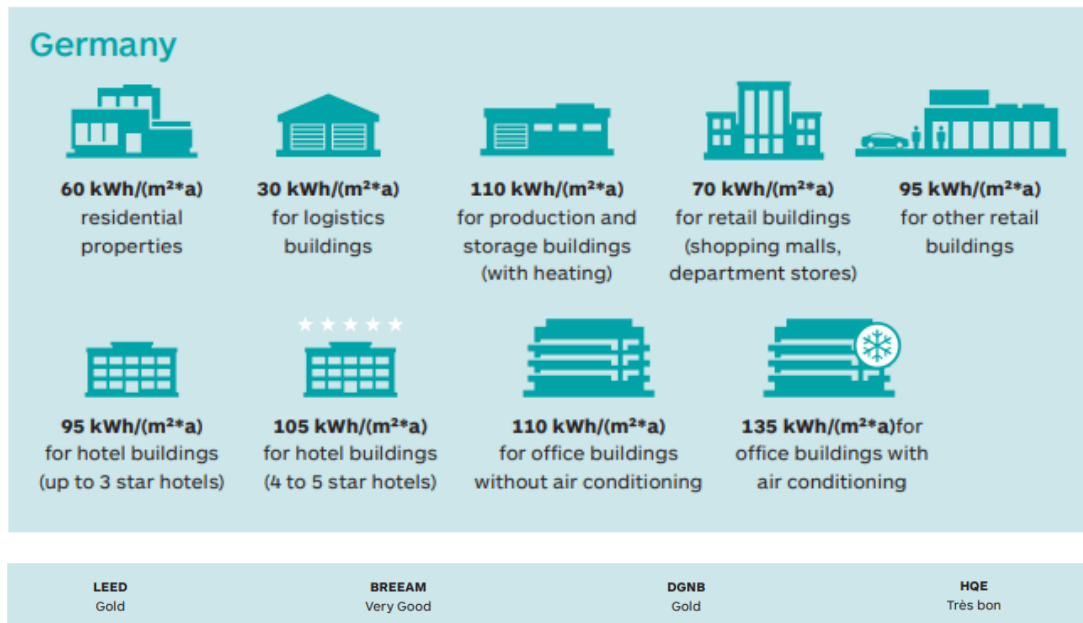


Figure 4. PED for various green buildings at a German green covered bond issuer  
(Source: NORD/LB, 2021)

In the case of Polish green residential buildings, the thresholds also differ depending on whether it is a new building, a renovation, or an acquisition. The various cases are detailed below with the maximum threshold for PED between 58.8 to 63 kWh/a/m<sup>2</sup>/year in case of a newly built nearly zero-energy building, while can be as high as 85 to 95 in the case of an acquisition, according to the green bond framework of the PKO BANK HIPOTECZNY, which would still represent the top 15% of the national building stock.

| Economic activity                          | Screening Criteria                                     | Residential Single-Family                                                                                                                                                                                                                                                | Residential Multi-Family              |
|--------------------------------------------|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| 7.1 Construction of new buildings          | Nearly Zero-Energy Building                            | At least 10% lower than the requirements for the primary energy demand of the "Nearly Zero-Energy Building" standard (NZEB). Based on the "Energy Performance of Buildings Directive" (EPBD), the NZEB-standard is implemented in Technical Condition 2014 requirements. |                                       |
|                                            | Primary energy demand minus 10%                        |                                                                                                                                                                                                                                                                          |                                       |
| Built 01/01/2021 or newer                  | Indicative reference values:                           | PED ≤ 63 kWh/( m <sup>2</sup> year)                                                                                                                                                                                                                                      | PED ≤ 58,8 kWh/( m <sup>2</sup> year) |
| 7.2 Renovation of existing buildings       | Major Renovation                                       | The building renovation complies with the applicable requirements for major renovations as defined in the EPBD, based on the cost optimal level as defined in Technical Condition 2014.                                                                                  |                                       |
|                                            | Cost optimal level                                     |                                                                                                                                                                                                                                                                          |                                       |
| Built before 31/12/2020                    | Property Upgrade                                       | Relative improvement in primary energy demand ≥ 30% in comparison to the performance of the building before the renovation.<br>Reductions through renewable energy sources are not taken into account.                                                                   |                                       |
|                                            | Relative improvement ≥ 30% in primary energy demand    |                                                                                                                                                                                                                                                                          |                                       |
| 7.7 Acquisition and ownership of buildings | Top 15% of the national existing building energy code  | Technical condition TC 2017 or newer                                                                                                                                                                                                                                     |                                       |
|                                            | Top 15% of the national existing building energy stock |                                                                                                                                                                                                                                                                          |                                       |
| Built before 31/12/2020                    |                                                        | PED ≤ 95 kWh/( m <sup>2</sup> year)                                                                                                                                                                                                                                      | PED ≤ 85 kWh/( m <sup>2</sup> year)   |
|                                            |                                                        | FED ≤ 67,7 kWh/( m <sup>2</sup> year)                                                                                                                                                                                                                                    | FED ≤ 60,6 kWh/( m <sup>2</sup> year) |

Table 2. Polish residential buildings  
(Source: PKO BANK HIPOTECZNY, Drees & Sommer, 2022a)

In Hungary, green residential buildings would also have to meet similar criteria. In order to qualify as a green building, the building should meet at least one of the criteria below, according to the green bond framework of the UniCredit



Bank: 1) Buildings with Energy Performance Certificate (EPC) class ‘A’ (before 1<sup>st</sup> of January 2016) or class ‘AA’ (after 1<sup>st</sup> of January, 2016). The exact PED was not explicitly defined. 2) The energy performance (PED) of the building is within the top 15% of the Hungarian building stock. In 2020, the threshold was estimated to be 118 kWh/m<sup>2</sup>/year using CBI’s methodology, which is expected to linearly decline to 0 by 20506 (Ritter, 2021). 3) Implementation of energy efficiency solutions or renovations in the buildings, which lead to a 30% increase in the energy efficiency of the building, or results in at least a two-step upgrade in EPC compared to the baseline before the renovation.

To sum it up, green definitions of issuers consider the same screening criteria (CBI and the EU Taxonomy) in all three jurisdictions, but the PED of new residential buildings in Germany (55–60 kWh/m<sup>2</sup>/year) and Poland are already quite low. Using the top 15% of the national building stock criteria would enable banks to finance buildings with a PED of 55–75 in Germany, 85–95 in Poland and around 100–118 kWh/m<sup>2</sup>/year in Hungary (UniCredit, 2021; OTP, 2021). These regional differences in particular for new buildings are expected to decline over time, the EU regulation on NZEB is also acting in that direction.

#### 4.4. Carbon emissions intensity

National Residential Mean Carbon Emissions Intensity calculation takes into account the composition of primary energy sources used in the national energy mix (these are the weights), which are multiplied by the standard CO<sub>2</sub>-Emissions factors of the respective energy inputs.

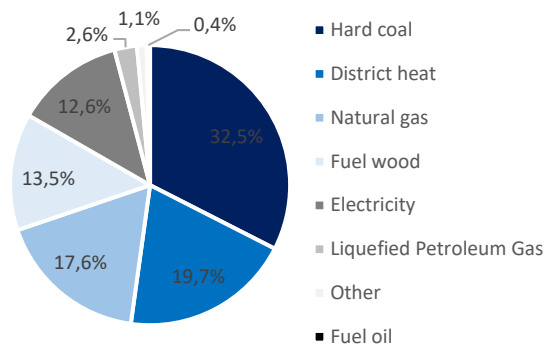


Figure 5. Composition of energy inputs

(Source: Drees & Sommer, 2020)

| Energy Type                             | Carbon Emission Equivalent (kgCO <sub>2</sub> /kWh) |
|-----------------------------------------|-----------------------------------------------------|
| Hard coal                               | 0,354                                               |
| Natural gas                             | 0,202                                               |
| Fuel wood                               | 0,403                                               |
| Liquefied Petroleum Gas                 | 0,249                                               |
| Municipal Wastes (non-biomass fraction) | 0,330                                               |
| Wood (non-sustainable forestry)         | 0,403                                               |
| Fuel oil                                | 0,279                                               |

Table 3. Standard CO<sub>2</sub>-Emissions factors

Applying the carbon emissions equivalents (GHG intensity) to the weighted average of energy inputs, the “national residential mean carbon emissions intensity” is calculated.<sup>7</sup> Using this number and multiplying that with the national primary energy demand of the building stock, the amount of national residential mean carbon emissions is calculated.

Data sources used for GHG intensities in the various impact assessments range from various studies and a multitude of sources.<sup>8</sup> These sources vary by the issuing country and the impact assessment provider, inevitably leading to less transparency and lack of standardization. The main issue is the lack of a uniform data source.

Therefore, a green mortgage can have fairly different GHG impact depending on the factors listed and described above. Differences are more significant in the building stock of these countries, with the building stock of Germany having the

<sup>6</sup> This threshold has been calculated together with CBI and the National Bank of Hungary, Eligible Residential Building – Hungary, 2021.

<sup>7</sup> Drees & Sommer (2022a): In the case of Poland, the national residential mean carbon emissions results in: 0.385 kgCO<sub>2</sub>/kWh. Using this number and multiplying that with the national primary energy demand of 210.6 kWh/m<sup>2</sup>/year × 0.385 kgCO<sub>2</sub>/kWh, we come to the national residential mean carbon emissions result: 81.0 kgCO<sub>2</sub>/m<sup>2</sup>/year.

<sup>8</sup> Wuppertal Institute (2022): GHG intensity of district heating refers to oekobau.dat data for Germany, cited in the DGNB framework for climate-neutral buildings and locations (DGNB, 2020: 61). All other intensities are drawn from the Covenant of Mayors (CoM) default emission factor document, provided by the European Commission (European Commission, 2017).



lowest GHG impact, having gone through the most thermo-modernization. There are also significant differences in the GHG intensities, the highest relative emitter is Poland, where the share of coal in the energy mix is the highest. While the PED of new buildings has already showed some convergence. In terms of impact per invested amount, the markets with the lower average real estate prices can offer a higher impact for the amount invested.

## 5. Challenges

Impact assessment is still primarily centered around GHG emissions. In the number of impact reports reviewed for the purpose of this article, the sole focus was on greenhouse gas emissions avoidance. There was only one assessment that had data on the share of new vs. refurbished buildings in the cover pool (NordLB), which could be an important input for analyzing the potential environmental impact of new construction vs. refurbishments. There is no mentioning of other scope 1 and 2 type of emissions, such as water efficiency, savings, waste management etc. There was no mentioning of scope 3<sup>9</sup> metrics, such as the potential use of materials with lower environmental footprint, the land use and biodiversity aspect for new buildings or other qualitative aspects that benefit the users of the buildings, such as transport connectivity. There are two main reasons for the lack of such data. The assessments reviewed here were either related to residential or mixed-use cover pools, where this type of data is either not available or could not be aggregated, although for newer commercial buildings, this type of data should be available in the certificates (such as Breem, Leed etc.) This is broadly in line with the findings of the Climate Bonds Initiative's third study of post-issuance reporting in the green bond market. (CBI, 2021)

Data quality and availability is a limiting factor in the quality of impact assessments. While ideally the energy performance of each building in the cover pool should be available to the issuer and to the impact assessment provider, that is sometimes not the case. Data quality can vary on a case-by-case basis, depending on the issuer, pool, building type, assessment provider, country etc. The quality of the cover pool data is usually not disclosed, only mentioned specifically in one impact assessment.

A typical example for a data challenge is when the PED of the financed buildings is not known. In one particular example, the impact assessment provider employed a conservative estimate to correct for the missing data and applied the maximum allowed PED within the green bond framework (MünchenerHyp, 2021). In a low number of cases, other data may be missing, or the building type may not fall into the typology of existing buildings. When no suitable reference building can be selected, the lowest PED for buildings in stock (conservative estimate) are used. In other cases, more important data, such as the floor area may be missing, which can be estimated from the value estimate and the total costs per square-meter of all other buildings in the sample in order to ensure a conservative estimate. The chart below is a rare example detailing the data quality of the German residential and commercial cover pool available to the impact assessment provider. While the methodology given by the Wuppertal Institute is one of the most detailed and transparent ones, it shows that data quality, even in the case of office buildings and German residential buildings, can be an issue requiring a number of assumptions (Wuppertal Institute, 2022). Some impact assessment providers emphasize that their assumptions and calculations use conservative estimates for the avoided GHG emission potentials. For example, the energy savings in the actual buildings compared to buildings in stock are expected to be larger than shown in the impact assessment. In terms of overall accuracy, the lack of data for electricity use leads to less accurate results.

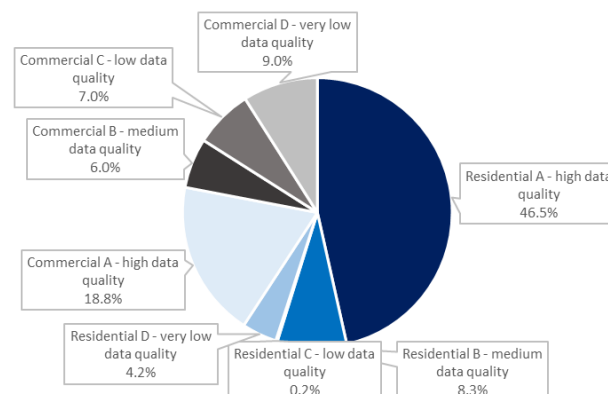


Figure 6. Data challenge example – MünchenerHyp portfolio analysis  
(Source: MünchenerHyp, 2021)

<sup>9</sup> Scope 3 emissions are all indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions



For residential impact assessments, there are various data sources, studies available for the PED of the national building stock. However, even in the best of cases, these are geographically fragmented, in some cases quite outdated with e.g. the impact of thermo-renovations not included. There are also various data gaps; and therefore, most jurisdictions impact assessment providers must come up with their own estimates, using various assumptions. While PED data on the cover pool is of better quality in Germany, there are still significant data gaps. More significant data gaps appear to be in Hungary, where data is incomplete both for the primary energy demand (PED) of the cover pool and that of the building stock. The former is expected to improve rapidly, as mortgage banks are now aware of the data required for impact assessment reports and will likely increase their efforts to collect and store any related data, such as the environmental certificate of the financed buildings (CBI, 2017b).

Another challenge is that the EU pays more and more attention to GHG emissions caused by construction and renovations, but these barely appear in the impact reports. The renovation wave plays a key role in upgrading existing buildings and making them more energy efficient, and it will be an important element in achieving a climate-neutral EU by 2050. Many studies have shown that extending the life cycle of a building has a lower environmental impact than new construction and demolition. By avoiding or delaying the use of new materials in buildings, circular economy-based approaches to renovation can help to reduce embedded greenhouse gas emissions and contribute significantly to achieving climate neutrality (European Commission, 2020).

## 6. Conclusions

Green covered bonds are still a relatively new asset class, green bond frameworks and environmental impact assessments have only been around for a few years, with the first green covered bond (Pfandbrief) issuance in 2015 in Germany, 2019 in Poland and 2021 in Hungary (with the very first impact reports just out recently).

The green bond market and impact assessments overall have come a long way in a relatively short period of time, with every major covered bond issuer having issued at least one green bond, set up a green bond framework and have commissioned an environmental impact assessment.

Notwithstanding, there are a lot of areas for improvement, such as a need for much better, more granular data, as well as more transparency on the data front in the impact assessment reports. There are significant data challenges that impact assessment providers need to tackle. It would be best if they did that in an open and transparent manner, disclosing what is missing, where they had to fill data gaps and make assumptions.

It would also be welcome to have more transparency on how environmental impact is measured and calculated. More unified and better data sources would be welcome, potentially on a pan-European level. Focus should be broadened to beyond GHG emissions to include other scope 1 and 2 but also scope 3 building emissions that are already included in several impact reporting recommendations.

While many believe that the green covered bond market and impact assessments may have a significant impact on how the real estate sector evolves, the authors of this article are of the view that the push from bond investors alone will not be sufficient to force a further radical greening of the real estate sector. Stricter but also sensible regulation potentially far out in the future may be needed to provide further impetus (similarly to cars), a case in point is the EU regulation for Net Zero Energy Buildings. Similarly, there are also initiatives to limit and measure other emissions, increase savings, and use building materials and technologies with lower carbon footprints.

A sustainability revolution is required that would go beyond and encompass sustainable architecture. A lot of complex technologies can be avoided if engineering design properly balances regional environmental impacts and building materials with the potential of technology. According to the theoretical architect Lebbeus Woods (Manauagh 2007), fundamental changes in the architecture of the future cannot take place until humanity changes its current sociological model, and this change must have regional diversity to be sustainable. The architecture of the future must reduce the carbon footprint of construction and operation, while providing flexibility that adapts to the functional needs arising from changing social and sociological influences during the building's lifetime (Cognitive Sustainability in Cognitive Sustainability, 2022).



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