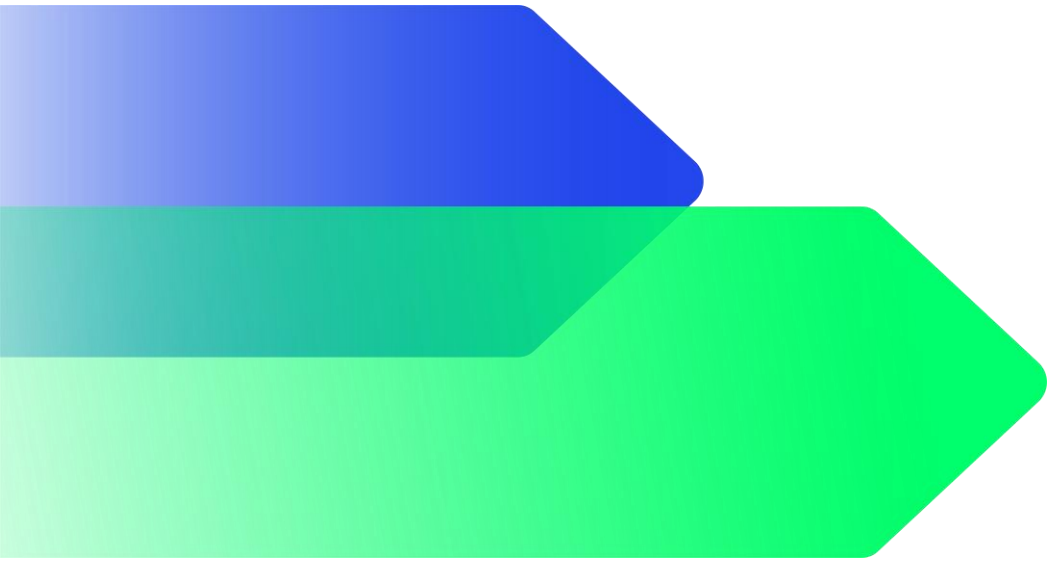
REPORT

PTSB Green Mortgage Impact Assessment Methodology

For eligible Green Mortgage loans in Ireland.

December 2023



Contents

Abbreviations

Avoided carbon emissions	The avoided carbon emissions of the underlying properties when comparing them against a baseline of the average property across Ireland, on an annual basis. The avoided emissions are a result of these properties being more efficient and less carbon intensive than the average property in Ireland
Baseline	The average energy and carbon intensity of properties by sector and geography, informed by the SEAI datasets
BER (Building Energy Rating)	An indication of the energy performance of residential or commercial premises (represented as kWh/m^2/year) in Ireland
Delivered Energy	The amount of energy that enters the building (and is used) without adjustment for any energy loss in the generation, transmission, and distribution of that energy
Eligible Green Loan Portfolio	The pool of eligible assets as outlined in the PTSB Green Bond Framework
Primary Energy	The total amount of energy used, including the final energy used directly by the end-user, but also the energy inputs to transformation processes such as electricity generation and oil refining and other losses such as electricity transmission and distribution
SEAI BER Research tool	Developed by the SEAI and provides a database of BER certificates for alldomestic properties in Ireland (that have been assessed)
SEAI non-domestic database	A database provided by SEAI containing the BER certificate data of non-domestic properties in Ireland (that have been assessed)

Introduction

Carbon Trust - Who we are

Our mission is to accelerate the move to a decarbonised future. We are your expert guide to turn your climate ambition into impact.

We have been climate pioneers for more than 20 years, partnering with leading businesses, governments and financial institutions to drive positive climate action. To date, our 400 experts globally have helped set 200+ science-based targets and guided 3,000+ organisations and cities across five continents on their route to Net Zero.

PTSB Overview

Aligned with its sustainability strategy, Permanent TSB ("**PTSB**") intends to issue finance and / or refinance Green Eligible Loans with a positive environmental benefit that meets the requirements as described in the PTSB Green Bond Framework ("**Framework**")[1]. The objective of the Framework, and subsequent loans issued from it, is to use an amount equal to the net proceeds of any green bond instrument to fund assets that help to mitigate climate change through reduced carbon emissions and energy demand, protect vulnerable ecosystems, and support the ten strategic outcomes of Project Ireland 2040[2], the 17 UN Sustainable Development Goals[3] and Irelands Climate Action Plan[4]. The Framework has been aligned with the ICMA Green Bond Principles and has received a Second Party Opinion from Sustainalytics.

The ICMA Green Bond Principles are a set of voluntary guidelines that recommend transparency and disclosure and promote integrity in the development of the green bond market by clarifying the approach to issuing a green bond. The Framework therefore has four key components:

1. Use of Proceeds
2. Process for Project Evaluation and Selection
3. Management of Proceeds
4. Reporting

PTSB, at its discretion but in accordance with the Framework, will allocate the net proceeds of the Green Bonds to an eligible loan portfolio of new and existing green loans ("**Eligible Green Loan Portfolio**"). The Eligible Green Loan Portfolio are to be financed and/or refinanced in whole or in part by an allocation of the bond proceeds.

---

[1] PTSB Green Bond Framework

[2] Project Ireland 2040

[3] THE 17 GOALS | Sustainable Development

[4] Climate Action Plan 2023

The Eligible Green Loan Portfolio will exclusively finance or refinance assets according to the criteria set out below[1]:

New Residential Buildings

- For building completed prior to the 1st of January 2021
    - Those that belong to the top 15% of the most energy efficient buildings in the Republic of Ireland.[5]
- For building completed on or after the 1st of January 2021
    - Residential buildings that have a primary energy demand >10% lower than the local Nearly Zero-Energy Building (NZEB) regulation.[6]

Lending for the refurbishment of Residential Buildings

- For a building to achieve 30% energy efficiency improvement (PED)[7]
    - When such an improvement is derived from BER labels between prior and post of the refurbishment, a minimum floor of a "C3" BER label will be implemented.

PTSB would like to report on the avoided energy and emissions impact of the Eligible Green Loan Portfolio financed and/or refinanced on an annual basis. Avoided emissions in this analysis are defined as the avoided carbon emissions of the underlying properties when comparing them against a baseline of the average domestic property in Ireland, on an annual basis.

The avoided emissions for both new residential buildings and refurbished buildings are a result of these properties being more efficient and less carbon intensive than the average respective property type in Ireland. The Carbon Trust has therefore been commissioned to develop a methodology and tool to allow PTSB to calculate the annual avoided emissions impact within the Eligible Green Loan Portfolio.

[5] At the time of writing, based on publicly issued governmental statistical data, Irish residential buildings with BER rating of A, B1 and B2 are in scope. See methodology document here.

[6] In line with the EU EPBD directive, Ireland carries out a cost optimal analysis to define NZEB requirements. PTSB will calculate the NZEB-10% threshold as per the official cost optimal analysis, as published by the Department of Housing, Local Government and Heritage. At the time of writing, the cost optimal analysis for residential buildings can be found here.

[7] Or alternatively, renovation complying with applicable requirements for major renovations as set in the applicable national and regional building regulations for 'major renovation' implementing Directive 2010/31/EU.

Methodology

Reporting Principles

Reporting of the environmental impacts of green assets is evolving and is a relatively new concept. However, PTSB is committed to reporting on the method used to calculate the avoided GHG emissions for its Green Mortgages based on:

- *PCAF's The Global GHG Accounting and Reporting Standard Part A: Financed Emissions (2022)[8];*
- *ICMA Harmonised Framework for Impact Reporting (2023)[9];*
- *IFI GHG Accounting for Grid Connected Renewable Energy Projects (April 2022)[10];*
- *Green Bond Principles, Voluntary Process Guidelines for Issuing Green Bonds (June 2022)[11];*
- *Climate Bonds Standard V3.0[12];*
- *Green Loan Principles (Feb 2021);*
- *Green Bond Principles, Voluntary Process Guidelines for Issuing Green Bonds (2021); and,*
- *WBCSD Guidance on Avoided Emissions[13].*

PTSB follows the key recommendations outlined in the Green Bond Principles, with external reviewers present across their reporting process. In addition, PTSB is committed to reporting greenhouse gas emissions in accordance with the five principles contained within the Greenhouse Gas Protocol, namely: relevance; completeness; consistency; transparency; and accuracy. In accordance with the principles of reporting described above, PTSB commits to transparent disclosure of any assumptions and estimations used in the calculation.

Scope of Calculations and Reporting

PTSB intends to report the expected or actual quantitative environmental impact of the green loans it finances. The reporting includes the estimated reduction or avoidance of greenhouse gases ("**GHGs**") estimated to have occurred from its loans. PTSB also evaluates other indicators that are appropriate to report for environmental impact and performance, such as the signed amount and total consumption (MWh). At this stage, social, other economic and governance indicators are not within the scope of the green bonds in question.

The reporting includes both green indicators and resulting emissions reductions or avoidance, both of which require assumptions and calculations. The reporting is based on the net benefit resulting from the

---

[8] PCAF (2022). The Global GHG Accounting and Reporting Standard for the Financial Industry. second edition

[9] Handbook Harmonised framework for impact reporting (June 2023)

[10] AHSA-001 - IFI Approach to GHG Accounting for Renewable Energy Projects

[11] ICMA (2021 (with June 2022 Appendix I)), Green Bond Principles, Voluntary Process Guidelines for Issuing Green Bonds

[12] Climate Bonds Standard V3.0 | Climate Bonds Initiative

[13] WBCSD Guidance on Avoided Emissions (Mar 2023)

asset in a given period of operation, rather than the gross emissions change before or after the life of the asset or project.

Calculations include property-by-property impacts, as well as aggregated results across the portfolio of Green Mortgages. Environmental indicators are attributed to PTSB on a property-by-property basis, based on the current percentage share financed (where applicable) and disbursed by the bank. The reporting is undertaken on an annual basis, covering the previous 12-month period and considers any dynamic changes in the assets financed or co-financed that occur from one reporting period to another.

Residential Properties in Ireland: Building Energy Ratings (BER)

BER certificates in Ireland provide an indication of the primary energy performance of residential premises (represented as kWh/m^2/year). The certificate rates each building on a scale of A-G with A being the most energy efficient and G the least energy efficient. Since 2007 a BER certificate is mandatory for all the buildings being constructed, offered for rent or sale in Ireland.

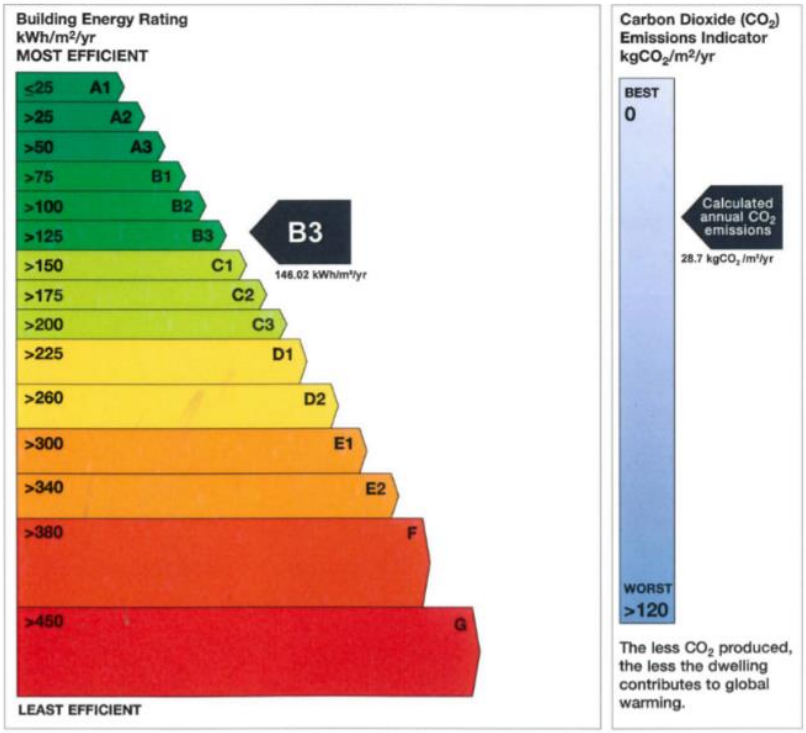


Figure 1 Illustration of a BER certificate indicating the A-G scale and the building rating of B3 in this instance. The BER certificate also provides information on the kWh/m^2/year and kgCO_2/m^2/year.[14]

A BER indicates the primary energy performance of a dwelling based on the energy used for space and hot water heating, ventilation and lighting. BER certificates also provide information on the total emissions of the property in kgCO_2/m^2/year, which is determined by the source of energy supply such as electricity, natural gas etc. Actual performance will depend on how the occupants operate the dwelling and there is often a performance gap.

BER ratings and calculations are based on the major characteristics of a property including building orientation, insulation levels, type, efficiencies and operation of heating, cooling, DHW and lighting

[14] BER used in figure 1 is for illustration purposes only.

systems. Occupancy patterns are also included in the calculation of a BER and these are modelled based on notional building use assumptions. However, the actual energy consumption of the property may vary significantly, depending on occupancy patterns, systems controls and operations and may differ significantly from assumptions made in a BER calculation. Despite the stated limitations, BER data is considered to be a good relative indicator of projected primary energy consumption and carbon emissions and is the best proxy to use given that PTSB does not have access to the actual energy consumption and carbon emissions of their pool of Residential Buildings.

The methodology is designed to cope with certain limitations in the BER data that is extractable from PTSB systems at present. For example, for some mortgages only the BER category (A1, A2, etc.) is extractable, and for others no BER information is available at present. The methodology will however utilise the building specific BER energy and carbon intensities when they become available.

The Sustainable Energy Authority of Ireland National BER Research Tool

The Sustainable Energy Authority of Ireland (**"SEAI"**) has developed the National BER Research Tool[15] which provides access to the BER certificate data for all domestic properties in Ireland (that have been through the BER assessment process). The database provides BER certificate data and information for approximately 1,038,133 domestic properties (as of November 2023, 828,747 from 1,021,278 properties in February 2022) in Ireland and consists of properties built between 1753 to 2023.[16] This database represents approximately 59% of all domestic properties when compared against the 2022 Census of Population[17].

The data provided in the BER Research Tool is used to establish the baseline (country average) in Primary energy use (kWh/m^2/year) and carbon emissions ($kgCO_2/m^2$/year) for domestic properties in Ireland.

SEAI states in the User Information Guide of the BER tool that it manages a quality assurance system for the BER database, however, it takes no responsibility for undetected errors in the data set. Therefore, the Carbon Trust has performed a supplementary analysis of the BER database. BERs that, to the best of our knowledge, are considered unrealistic have been excluded from inclusion in the BER analysis. Specifically, BER values of a) zero or less and b) 500kWh/m^2/year or more, have been excluded.

The Carbon Trust assumes that there are no duplicates in the SEAI database, as has been verbally confirmed by representatives at SEAI. It is understood that if a property has been through multiple BER assessments, the latest (newest) BER certificate data is presented in the database. Therefore, all properties, excluding the outliers mentioned in the previous paragraph, have been considered in the analysis.

The weighted average primary energy intensity of all domestic properties in Ireland, which have a BER certificate and are included in the latest available data in BER Research Tool (excluding the outliers mentioned above) is estimated to be 199.8 kWh/m^2/year. The weighted average CO_2 emissions intensity for the same properties is estimated at 45.6 $kgCO_2/m^2$/year. This data is correct as of November 2023.

---

[15] SEAI - National BER Research Tool

[16] The latest update of the SEAI database was used in the PTSB impact tool dated 07/11/2023

[17] Household Size and Marital Status - CSO - Central Statistics Office

It is worth noting that BERs became mandatory in Ireland in 2009, with all new buidings and those that are rented or sold requiring a certificate. This means that the SEAI database is skewed towards newer and more energy efficiency properties, with a lag in older private propertiers that may not yet have a certificate. As of November 2023, 42% of BER Certificates being properties constructed past the year 2000.

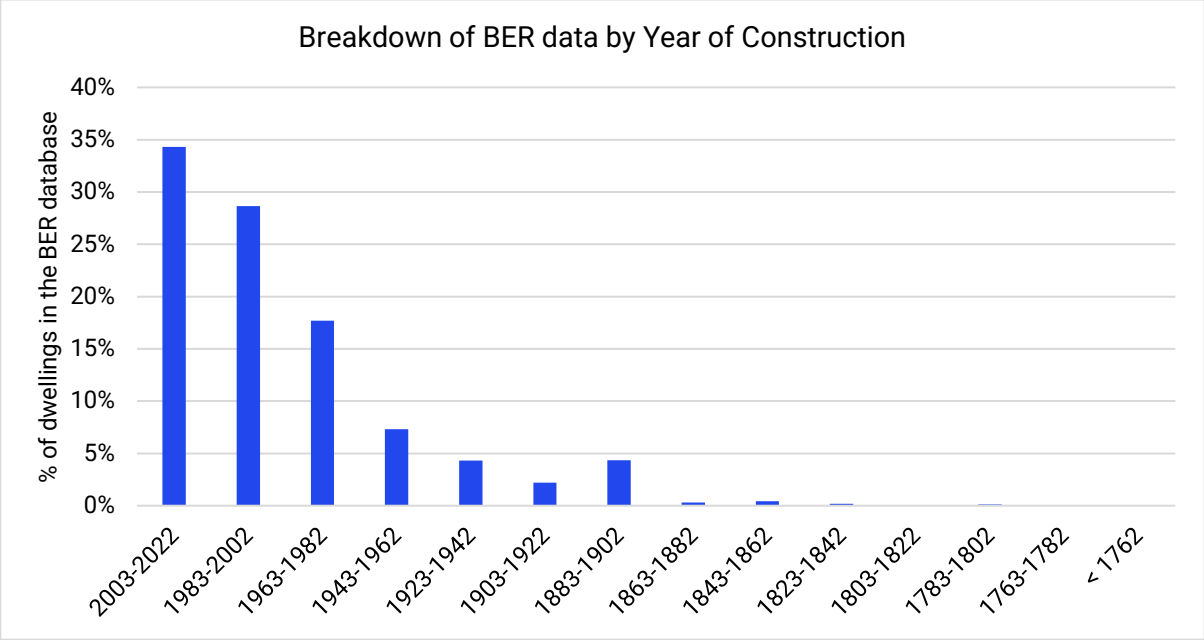


Figure 2 - Breakdown of BER database by year of construction

SEAI Data Updates – Energy Factors and Carbon Emissions Actors

It has been communicated from SEAI that new properties added to the BER database from 1 November 2019[18] will be assessed using updated carbon emission factors and energy factors. From analysis of the data, prior to this date, these had remained constant.

Energy factors are used to calculate the primary energy from the delivered energy figures. Delivered energy is the actual amount of energy consumed by the household, while primary energy includes an allowance for the energy "overhead" incurred in extracting, processing, and transporting fuel or other energy carrier to the building. The default data point modelled in a BER assessment is the delivered energy figure and primary energy figures are the obtained via a primary energy factor applied to the total delivered energy. Similarly, the CO_2 figures are estimated using an emission conversion factor applied to the delivered energy value for the individual use case at the property.

The primary energy factor and CO_2 emission factors for electricity have been reduced from 2.7 to 2.08 and from 0.643 $kgCO_2/kWh$ to 0.409 $kgCO_2/kWh$ respectively. These reflect the decarbonisation of the broader energy system in Ireland.

SEAI do not retrospectively apply the new carbon emission factors and energy factors to the entire dataset, they get corrected over time when new BER certificates are issued for each property. Therefore, any new PTSB properties added to the pool that have their BER certificates calculated in

[18] SEAI - Roadmap for DEAP

2020, will be calculated using updated emission factors and energy intensities. The baseline therefore will be artificially higher than it should be. To counter this issue, the methodology takes into consideration the primary energy consumption. This allows the Carbon Trust to use the most up to date emissions factors for the grid and specific fuel types of each properties to get a more accurate understanding of the emissions per dwelling.

In order to test the materiality of this, a bottom-up analysis was conducted by the Carbon Trust, applying the updated energy and carbon emission factors to the entire dataset using the detailed delivered energy data provided by SEAI. The impact of this on the final impact numbers was <-10%.

PTSB Data Gaps

Where PTSB only has the BER category (e.g., A1, A2) on file for each domestic property development, the SEAI National BER research tool has been used to estimate the carbon and energy intensity for those properties. To do this, the weighted average intensities for the properties contained in the SEAI BER Research Tool have been calculated for each BER category.

Where PTSB did not have the respective BER category but contained the dwelling type, an estimate was made based on the year of construction of the properties in line with policy at the time of construction. Following this estimate, the SEAI National BER research tool has been used to estimate the carbon and energy intensity for those properties based on the average values for the respective BER and dwelling type.

To account for data availability challenges when estimating the avoided emissions associated with a Residential Property, three options have been made available, all of which provide a sufficient understanding of the emissions associated with the property to assess the impact. These options take into account the dwelling sepcfic fuel type, BER rating and dwelling type. More detail is provided on the three options in the following section. When carrying out the assessment, which option has been used will be recorded to provide a breakdown of the data quality of the register.

Impact Calculation

Residential Properties Emissions Calculation

Option 1 – Actual Energy Consumption

1a – Actual energy consumption against supplier specific emissions factor and floor area

$$\boldsymbol{Property\ Emissions\ Intensity}\ (\boldsymbol{kgCO_2e/m^2}) = \sum (Actual\ Energy\ Intensity\ (kWh/m^2/year) \times Supplier\ Specific\ Emissions\ Factor\ (kgCO_2e/kWh)$$

1b – Actual energy consumption against nationally specific emissions factor and floor area

$$\boldsymbol{Property\ Emissions\ Intensity}\ (\boldsymbol{kgCO_2e/m^2}) = \sum (Actual\ Energy\ Intensity\ (kWh/m^2/year) \times Nationally\ Specific\ Emissions\ Factor\ (kgCO_2e/kWh)$$

Option 2 – Estimated Energy Consumption

2 – Estimated energy consumption per floor area based on BER rating and floor area

$$\boldsymbol{Property\ Emissions\ Intensity}\ (\boldsymbol{kgCO_2e/m^2}) = \sum (Estimated\ Energy\ Intensity\ (kWh/m^2/year) \times Nationally\ Specific\ Emissions\ Factor\ (kgCO_2e/kWh)$$

Option 3 – Property Type Estimate

3 – Estimated energy consumption based on property type and location specific statistical data

$$\boldsymbol{Property\ Emissions\ Intensity}\ (\boldsymbol{kgCO2e/m^2}) = \sum (Estimated\ Property\ Type\ Energy\ Consumption\ (kWh/m^2/year) \times Nationally\ Specific\ Emissions\ Factor\ (tCO_2e/kWh)$$

Residential Properties Avoided Emissions Calculation

To calculate the impact of the pool of Green Mortgages, it is necessary to understand the annual carbon footprint of each property and then compare it against a suitable baseline, to understand its incremental impact. The identified baseline is the annual carbon emissions of the average domestic property, across Ireland. This aligns with the approach used in the green bond market for assessing the impact of green bonds that are financing/ refinancing residential and commercial properties. The specific approaches for respective baseline calculations and proxy data are given below.

Step 1 – Calculation of Baseline Carbon Intensity

$$\boldsymbol{Baseline\ Carbon\ Intensity}\ (\boldsymbol{tCO_2e/m^2/year}) = \frac{\sum Carbon\ Intensities\ of\ Properties\ in\ SEAI\ National\ BER\ Tool\ (tCO_2e/m^2/year)}{Number\ of\ Properties\ in\ SEAI\ National\ BER\ Tool}$$

Step 2 – Calculation of Avoided Emissions

$$\boldsymbol{Avoided\ Emissions}\ (\boldsymbol{tCO_2e/year}) = (Carbon\ Intensity\ of\ Property\ (tCO_2e/m^2/year) - Baseline\ Carbon\ Intensity\ (tCO_2e/m^2/year)) \times Floor\ Area\ of\ Property\ (m^2)$$

Attribution Calculation

As per the guidance of the Partnership for Carbon Accounting Financials (PCAF), and in line with the ICMA Reporting Metric and Databases Harmonised Framework, it is recommended that PTSB *also* report their attribution.

The area of impact assessment related to green bonds and more widely the accounting of financed carbon emissions is developing rapidly. Our aim is to represent current best practices and where possible move that forward. To this end we have considered current market practice, recognised impact reporting standards including ICMA's Harmonised Framework for Impact Reporting, and from the related area of emissions reporting, the PCAF methodologies, specifically around attribution.

$$\boldsymbol{Attribution\ Factor} = \frac{Outstanding\ Amount\ (EUR)}{Property\ Value\ at\ Origination\ (EUR)}$$

If neither the total project cost nor property value at origination is available, then following the PCAF approach, the loan-to-value ratio will be applied.

carbontrust.com

+44 (0) 20 7170 7000

Published in the UK: 2022