



**Annual Reporting 2016/17
Green Bonds**

Editorial



Dear Sir or Madam,

Today, two years to the day since we issued our first Green Pfandbrief and one year after publishing our first annual reporting on 27 April 2016, marks the publication of our second report on the development of the Berlin Hyp green finance portfolio. The structure of this year's report may be similar to last year's, but the bank has made significant progress in terms of its approach to financing green buildings and issuing Green Bonds.

That's why, in this report, we have devoted the first section to giving you an insight into the process involved in financing green buildings and refinancing through Green Bonds. The rest of the report includes details on the development of our green finance portfolio, new business concluded in the reporting period and avoided carbon emissions achieved as a result:

A – Green Finance / Green Bond Process at Berlin Hyp

B – Portfolio Report

C – New Business Report

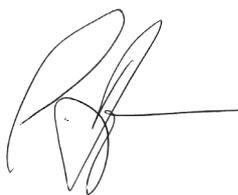
D – Impact Report

Financing particularly energy efficient buildings at Berlin Hyp was something of a side business a few years ago, but now it is a core part of the bank's strategy and became incentivised for the first time in 2016. We continue to pursue our passion and offer financings for green buildings at terms that are 10 basis points lower than normal loans. Promoting the purchase or construction of energy efficient buildings is our contribution to avoiding carbon emissions, in the full knowledge that real estate accounts for over one-third of these harmful gases. At the same time it is our firm belief that modern, low-consumption buildings are part of our future and that their value will outperform the value of less efficient and less sustainable buildings moving forward, especially when real estate market growth is less dynamic than what we have experienced over the past few years. Incentivising our offering represents an investment in the sustainable financial success of Berlin Hyp.

Issuing Green Bonds gives us the best possible refinancing tool for this business, even though we rather have to use the plural meanwhile. Following on from the issue of the first Green Pfandbrief in 2015, we issued our first senior unsecured Green Bond in 2016. Just like the Green Pfandbrief, this benchmark issue helped to raise awareness of Berlin Hyp on the capital market and expand the investor base. Whereas the Green Pfandbrief attracted 15 new investors, the order book for the senior unsecured bond included 35 new institutional investors who had never before purchased a Berlin Hyp bond. In order to give investors a clear overview of the structure and function of our Green Bonds, we documented our Green Bond framework before the senior Green Senior unsecured was issued in our Green Bond Program, which we publish alongside all other relevant documents concerning green (re-)financing on our website at www.green-pfandbrief.com.

Berlin Hyp has also continued to develop and further standardised the structures and processes involved in financing green buildings and refinancing through Green Bonds. The Green Building Commission (GBC) includes representatives of all departments involved in the value chain – from initial customer contact through to the Green Bond issue – and is in charge of green finance processes and ensuring that the suitability criteria of the green finance portfolio are up to date. The GBC updated the criteria in April 2017 and increased the bank's requirements in terms of eligible sustainability certifications. For instance, the minimum level for LEED was increased to "gold" and for BREEAM to "very good". You can find the revised version of the Green Bond Framework on our website. The efforts made are paying off: Our green finance portfolio has more than tripled in volume since the issue of the Green Pfandbrief in 2015 and almost doubled in volume since our last annual reporting. Standing at just over € 2 billion, it already accounts for over eleven percent of the entire Berlin Hyp loan portfolio. That's something we're proud of! But we won't be resting on our laurels. That's why the Berlin Hyp Board of Management set itself the strategic target at the start of the year to increase the share of financing for green buildings in relation to the total portfolio to 20% by 2020. I hope you enjoy reading our second Green Bond annual reporting.

Yours sincerely,

A handwritten signature in black ink, appearing to be 'Gero Bergmann', with a horizontal line extending to the right from the end of the signature.

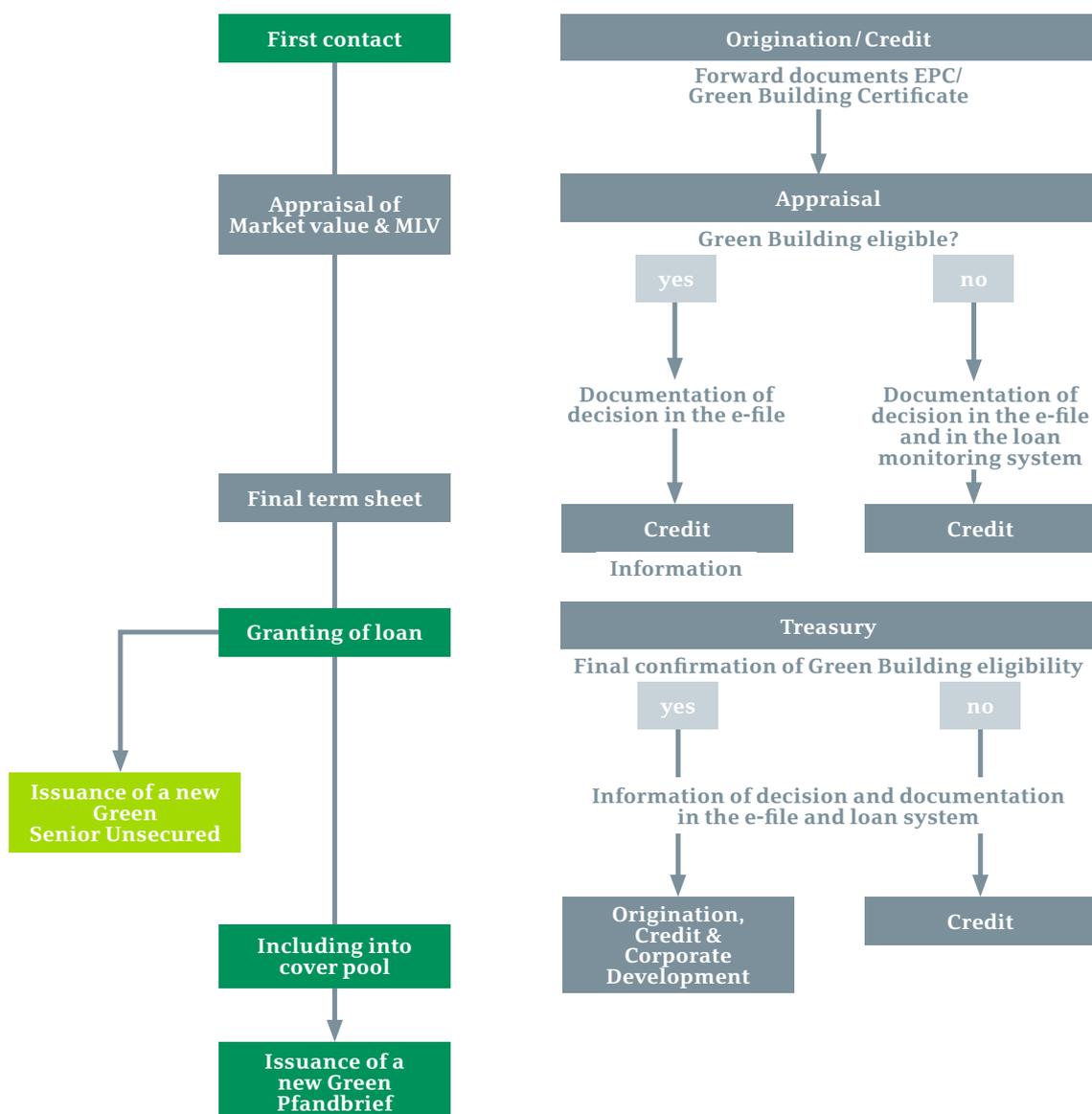
Gero Bergmann

A – Green Finance / Green Bond Process at Berlin Hyp

Incentivising the offering of loans for green buildings made it necessary to further standardise the processes involved in identifying and documenting eligible assets. At Berlin Hyp, borrowers are asked to submit documents evidencing eligibility for the green finance portfolio at the earliest opportunity. These documents usually consist of energy performance certificates (EPCs) and sustainability certifications relating to the buildings to be financed. Experts in the bank's Valuation department are then responsible for assessing the green building features of the property; afterwards they notify the Credit department of their decision. The Credit department is then tasked with documenting the decision in the electronic file. If the building is classified as a green building by the Valuation department, the Sales person in charge can make a deduction of 10 basis points in the preliminary calculation of the loan terms.

Once the transaction has been documented in the electronic file by origination, Treasury gives a second opinion confirming that it can use the corresponding assets for its Green Bonds. This ensures that the process of identifying eligible assets is subject to a two-person integrity system. Only loans for green buildings considered suitable by both Valuation and Treasury are subsequently labelled as green-bond-eligible by the Credit department in the bank's loan monitoring system. However, data concerning the energy efficiency and sustainability of the financed buildings is always stored in the loan monitoring system, even if loans are not considered suitable for the green finance portfolio. This process applies to all of the bank's new business, and so the long-term aim is for the bank to be in a position to assess the energy efficiency of its entire loan portfolio.

Process Green Finance



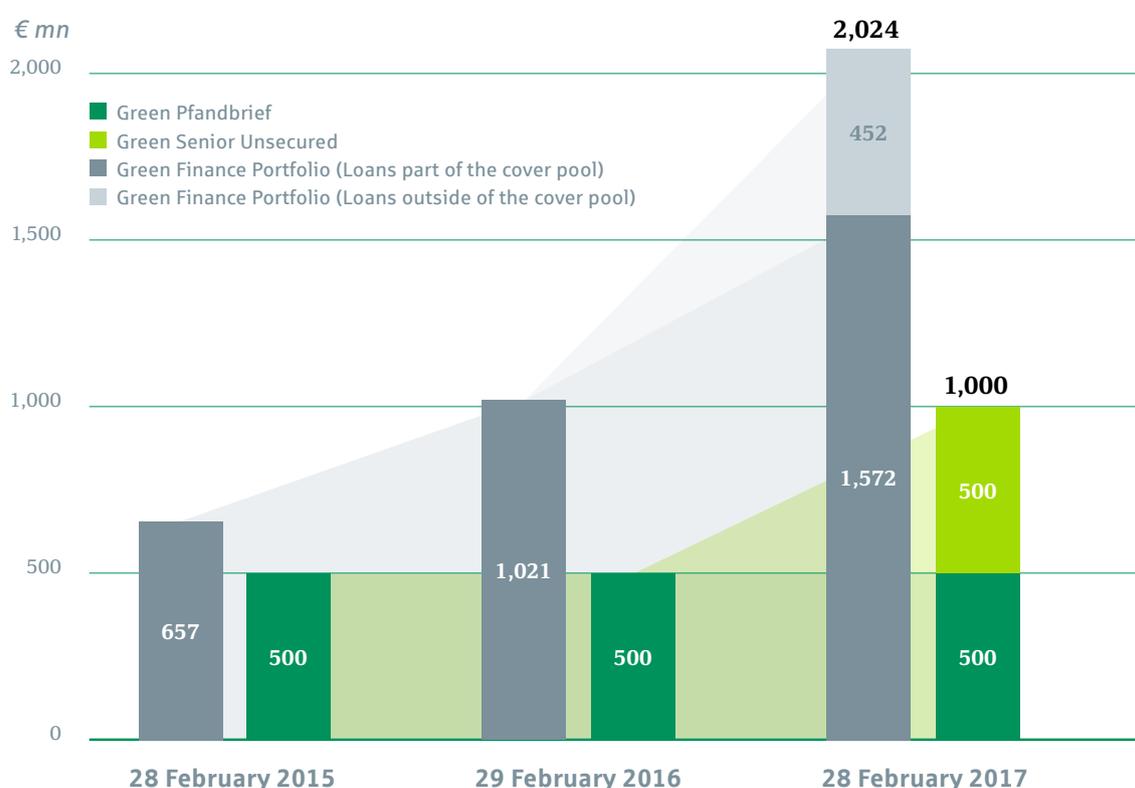
B – Portfolio Report – Development of the Green Finance Portfolio

In the wake of the first Green Pfandbrief issued in April 2015, Berlin Hyp issued another Green Bond in September 2016 – this time in senior unsecured format. This made it the first issuer with Green Bonds in two different asset classes. oekom research AG confirmed the sustainability performance of the Green Bond Program underpinning the issues by issuing a positive second party opinion, which it re-affirmed in the annual re-verification procedure in April 2017.¹

When the first Green Pfandbrief was issued, Berlin Hyp's mortgage cover pool comprised 17 loans for green buildings with a nominal value of € 657 million. By 29 February 2016, the number of green building loans in the cover pool had risen to 30, with a nominal value of € 1,021 million. The initial publication of the Green Bond Framework on 8 August 2016 saw the bank expand its green finance portfolio to include mortgage loans or parts thereof outside of the cover pool for the first time. On the closing date of 28 February 2017, the portfolio included 42 loans for green buildings with a total volume of € 2,024 million. More than three quarters of the portfolio is also in the Berlin Hyp mortgage cover pool.

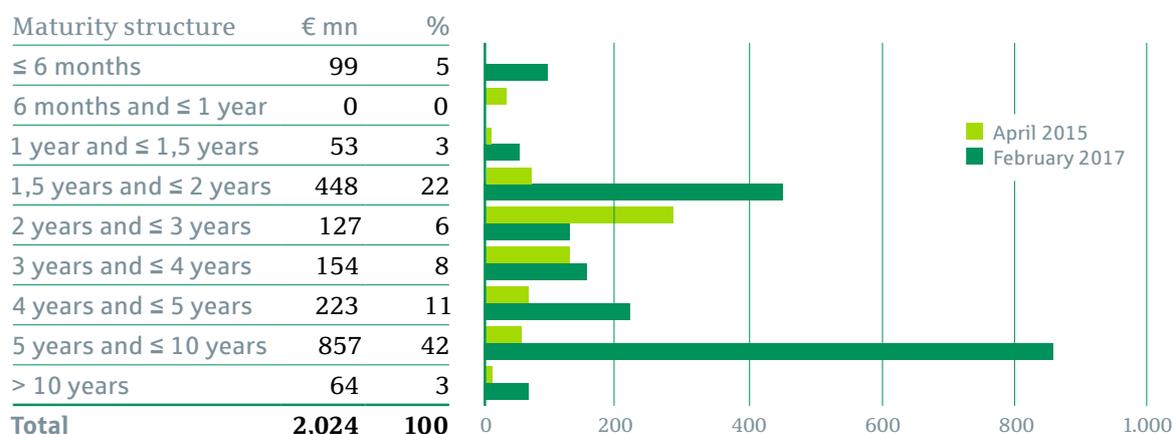
Nominal value € mn	Total	Inside mortgage cover pool	Outside mortgage cover pool	Number of loans
Total by 29 February 2016	1,021	1,021	–	30
– Repayments	–15	–15	–	–2
+/- Increase/Amortisation	–5	–5	–	
+ Subsequently identified already existing loans for green buildings	423	144	279	6
+ New loans for green buildings granted after 29 February 2016	600	427	173*	8
Total by 28 February 2017	2,024	1,572	452	42

* thereof € 153mn since issuance of green senior unsecured

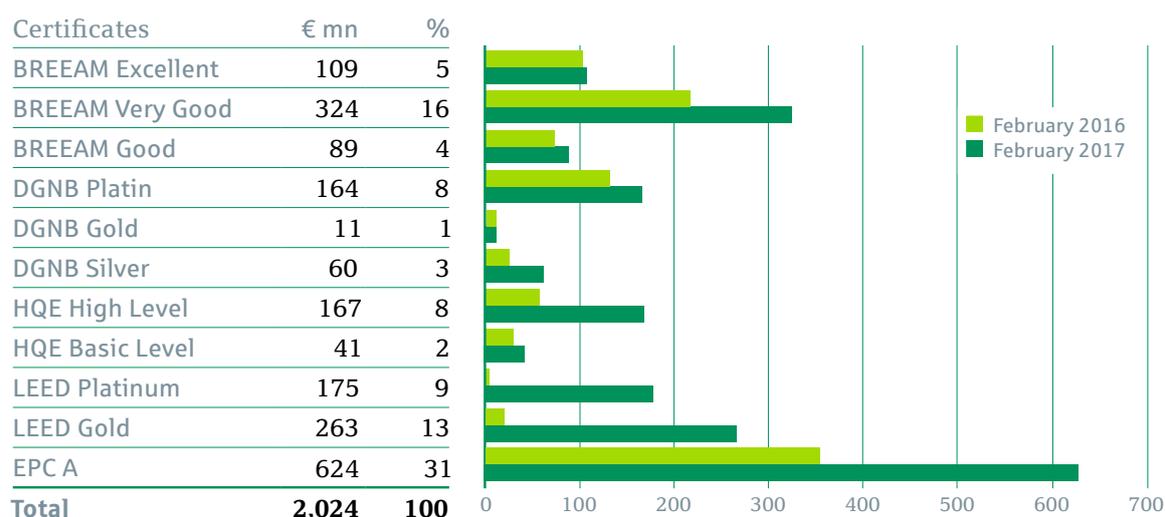


The loans for green buildings included in Berlin Hyp's green finance portfolio are classified according to various parameters in B.1 to B.4. All information relates to the closing date of 28 February 2017.

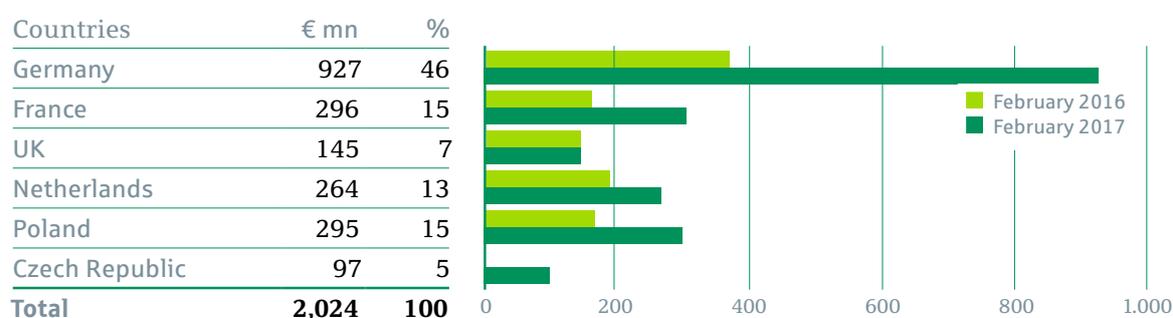
B.1 Loans for green buildings according to their term to maturity



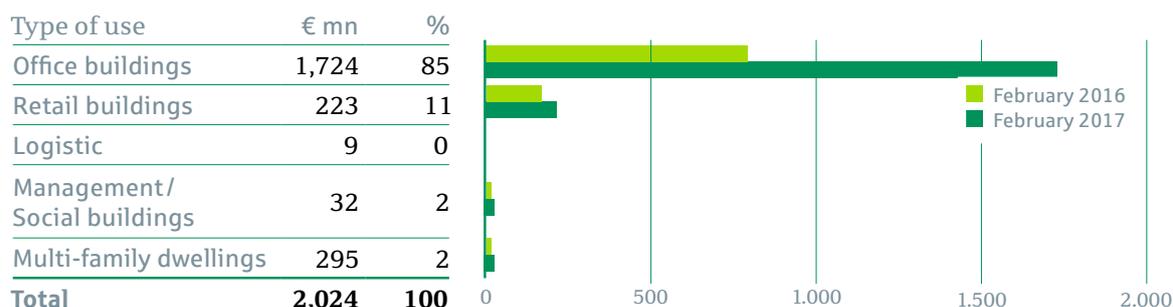
B.2 Loans for green buildings according to certification levels



B.3 Loans for green buildings according to countries



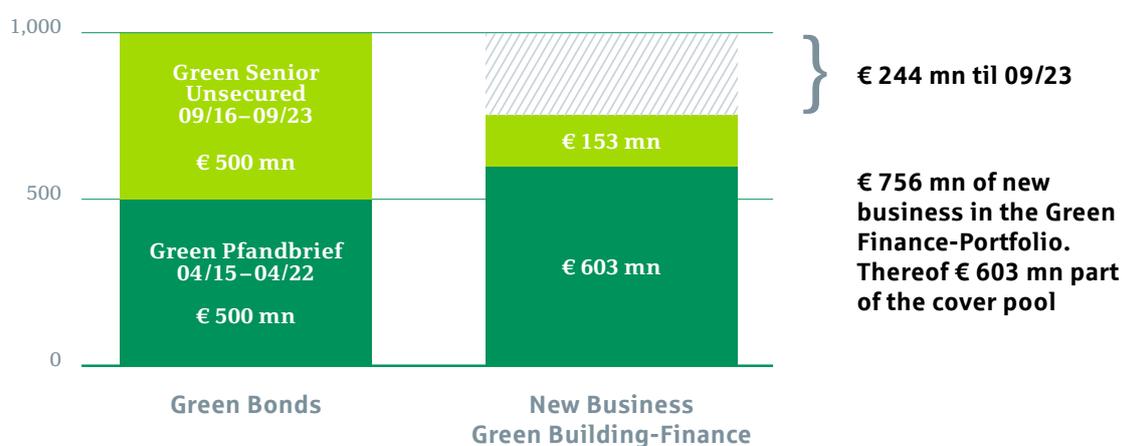
B.4 Loans for green buildings according to type of use



C – New Business Report

The Berlin Hyp Green Bond Program underlines that both Green Pfandbriefe and green senior unsecured Green Bonds serve to refinance loans for green buildings that are already on the balance sheet, whereby loans relating to the Green Pfandbrief must also be included in Berlin Hyp's mortgage cover pool. At the same time, the bank follows a best-effort approach when committing to investing an amount equal to the proceeds from the issuance of a Green Bond during its term in new loans for green buildings (and, in the case of Green Pfandbriefe, adding the amount to the cover pool). The following chart shows that this was achieved in the case of the Green Pfandbrief issued on 27 April 2015 in under two years. The bank only has to grant another € 244 million new loans for green buildings until 23 September 2023 to achieve the same target for the green senior unsecured bond issued on 19 September 2016.

New Business taken into Account for the Commitment *in € mn*



Eight loans with a nominal value of € 600 million used to finance 18 green buildings have been added to the green finance portfolio since the last reporting as at 29 February 2016 (as the date of issuance is relevant for the bank's commitment to invest an amount equivalent to a Green Bond's net proceed during its term, € 580 million can be used for the two already outstanding Green Bonds; see also subsequent table). Including the € 176 million of new business from the first reporting period between 27 April 2015 and 29 February 2016, a total of € 756 million has already been invested in new loans for green buildings since the issuance of the Green Pfandbrief. The following table lists the new loans in the current reporting period in anonymous form.

Loan	Type of use	Country	Granting of loan	Inside mortgage cover pool	Outside mortgage cover pool	Certificate	Type of project	Rentable area (m ²)	Energy demand (kWh/m ² *a)
1	Office	Germany	Jul. 16	17	4	EPC A	Financing	33,530	112
2	Office	Germany	Sep. 16	150	50	LEED Gold	Acquisition	82,670	69
3	Office	Poland	May 16	26	7	BREEAM Excellent	Acquisition	16,532	105
	Office	Poland				BREEAM Very Good	Acquisition	34,745	125
4	Office	Poland	May 16	26	6	BREEAM Very Good	Acquisition	29,011	115
	Office	Poland				BREEAM Very Good	Acquisition	11,975	125
5	Office	Netherlands	Jun. 16	7	3	EPC A	Financing	6,274	86
6	Office	Czech Republic	Nov. 16	8	0	EPC A	Financing	11,628	95
	Office	Czech Republic		7	0	EPC A	Financing	10,055	82
	Office	Czech Republic		6	0	EPC A	Financing	7,569	55
	Office	Czech Republic		10	0	EPC A	Financing	13,942	77
	Office	Czech Republic		7	0	EPC A	Financing	9,053	81
	Office	Czech Republic		10	0	EPC A	Financing	13,594	104
	Office	Czech Republic		7	0	EPC A	Financing	8,790	82
	Office	Czech Republic		6	0	EPC A	Financing	8,238	48
	Office	Czech Republic		22	0	EPC A	Financing	28,764	47
7	Office	Germany	Dec. 16	118	56	LEED Platinum	Acquisition	65,465	97
8	Office	Poland	Oct. 16	0	47	Breeam Very Good	Financing	14,531	105
				427	173				

D – Carbon reporting: Results and methodology

On the following pages you will find the results and methodology of our assessment of avoided carbon emissions owing to Berlin Hyp's Green Bonds. The calculations concern all green building financings added to the portfolio following the issuance of the first Green Pfandbrief (currently 31). Berlin Hyp was assisted in the calculations by the Crédit Agricole Sustainable Banking Team. The calculations were passed on to oekom research on a line-by-line basis, who reviewed the plausibility of the results in their re-verification on 27 April 2017². Due to data confidentiality this report only contains aggregate numbers. All calculations are again based on loan data as of 28 February 2017 and on the most current available energy performance certificate (EPC) and/or sustainability certification for each property. In six cases the energy efficiency of the properties had to be estimated as either only a sustainability certification was available or the EPC only contained the level of energy performance as a percentage number but not the final energy demand in kWh/m²*year.

D.1 Estimated avoided carbon emissions

Several assumptions significantly influence the estimation of avoided carbon emissions.

First, the quantification of avoided carbon emissions of a specific asset depends on the choice of a "baseline", i.e., the carbon emissions of a reference asset against which the carbon emissions of this specific asset are compared. This choice is highly sensitive since avoided carbon emissions decrease as the energy efficiency of the chosen baseline increases. This is particularly true in the real estate sector where buildings' energy performance varies a lot depending on asset type and construction year.

Second, another important decision is the way carbon emissions are allocated to one given asset. Practically, one can allocate the avoided carbon emissions of a given asset integrally to the debt holder or proportionally in the amount of the financing share.

In order to provide a maximum of transparency to investors, this carbon reporting includes four different estimates of avoided carbon emissions corresponding to two baselines:

- 1 An estimate of the average energy performance of existing European buildings provides the first baseline. It means that any building in the pool is compared to the average energy performance of existing European buildings. This baseline provides a rough estimate of the positive carbon impact of Berlin Hyp's Green Bonds assets.
- 2 Current energy reference values for different real estate asset classes according to the German Energy Savings regulation (Energieeinsparverordnung, EnEV) serve as a second baseline. This baseline gives a more conservative assumption of avoided carbon emissions.

In addition, the following two assumptions are applied to the avoided carbon emissions:

- 3 100% of the carbon impact of each asset is allocated to the Berlin Hyp financing.
- 4 Carbon impact allocated proportionally to Berlin Hyp's initial share in financing.

Results are provided in the table below:

In avoided tCO ₂ /€ mn/year	100% allocated to Berlin Hyp financing	Proportionally allocated to BerlinHyp initial financing share
against European average	28.7 (PY 26)	13.7 (PY 15.4)
against current EnEV standards	9.6 (PY 7.8)	4.5 (PY 4.7)

Avoided carbon emissions increased year on year for assets 100% allocated to Berlin Hyp financing. The fall in avoided emissions in the proportional figure was due to the decrease in the average LTV (loan/market value).

At portfolio level, avoided carbon emissions as a result of green building financings stood at between 4,100 and 22,700 tCO₂/year, depending on the baseline, as at the last impact report dated 30 June 2016. As at 28 February 2017, avoided emissions had risen to 6,600 to 41,700 tCO₂/year due to the increase in the volume of the green building financing portfolio.

The significant variance between estimations shows the importance of baselines and calculation assumptions in avoided carbon emissions reporting.

D.2 Principles of methodology

The methodology is based on a two-phase process:

I. An estimation of the energy savings per building, which includes:

- a: Assessment of each building's energy efficiency (kWh final/m²*year)
- b: Choice of the energy efficiency baseline (kWh final/m²*year)
- c: Calculation of savings in energy efficiency (I.a–I.b) (kWh final/m²*year)

II. An assessment of the carbon intensity of the energy saved based on the country context containing

- d: Determination of the carbon intensity of commercial buildings in each country given its energy mix (kg CO₂/kWh final)³
- e: Calculation of carbon intensity savings (c*d) (kg CO₂/m²*year)
- f: Estimation of total carbon savings (e*rentable surface of the building) (kg CO₂/year)
- g: Initial Market Value of building (€ mn) (Initial Loan/Initial Loan to Value (LTV))
- h: Outstanding nominal amount in the cover pool (€ mn)
- i: Berlin Hyp share expressed as a percentage of the initial market value of asset (Initial LTV) (%)
- j: Estimation of financed carbon savings (f*i) (kgCO₂/year)

D.3 Energy Efficiency Baselines

Two sets of comparable values were selected as energy efficiency baselines in order to provide different annual estimates of energy savings.

Baseline 1: Average energy efficiency of existing European buildings

Energy needs for heating, cooling and domestic hot water for buildings representative of existing building stock have been modelled in the European project ENTRANZE⁴. Single houses, multi-family dwellings, offices and schools are covered. In accordance with the composition of Berlin Hyp's green building financing portfolio, only the values for multi-family dwellings and offices are

considered for the present calculation. Values for selected relevant countries/cities (Berlin, Vienna, Prague, Paris and Helsinki) are averaged to obtain a robust baseline.

As a result, 207.1 kWh/m²*year is derived as a baseline of energy efficiency for European existing offices⁵ and 162.6 kWh/m²*year is derived as baseline of energy efficiency for existing European multi-family dwellings.

Baseline 2: Current energy references according to EnEV

This set of values allows an estimate to be made of the energy savings in green buildings in Berlin Hyp's green finance portfolio compared to current standards in Germany, and the values have been cross-validated against other sources⁶. As a result, values of energy efficiency baselines for current standards vary from 50 kWh/m²*year for multi-family dwellings to 135 kWh/m²*year for office buildings.

D.4 Carbon intensity of energy consumed by real estate sector

18 out of the 31 green building financings are collateralized by properties situated in Germany, six by properties situated in Poland and four by properties in the Netherlands. In addition, two are collateralized by properties situated in the Czech Republic and one by a property in France. Carbon intensities of energy used by the commercial real estate sector declined year on year. This is a pleasing development. However, it must be noted that a decline in carbon intensity leads to lower avoided carbon emissions:

Country	kgCO ₂ /kWh final energy demand	Δ yoy
Germany	0.351	-0.003
Netherlands	0.302	0.009
Poland	0.542	-0.030
France	0.146	-0.013
Czech Republic	0.450	-0.015

The detailed calculation of these values is presented in the Appendix.

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Appendix

The energy mix of commercial real estate in Germany, Poland and the Netherlands is available in the ENTRANZE project⁷. The following table summarizes the share of each energy source used by commercial buildings for their various usages (power, heating/cooling, any other use).

Country	Electricity & Heat (%)	Gas (%)	Oil (%)	Coal (%)	Biomass (%)
Germany	41.6	40.6	16.2	0.1	1.5
Netherlands	40.5	54.9	3.2	0	1.4
Poland	56.8	23.1	7.7	2.4	10.0
France	50.5	32.7	16.8	0	0
Czech Republic	52.6	42.8	0.5	2.6	1.5

Electricity and heat are often provided together as many buildings rely on local networks for their power and heating. In that case, it is assumed that the energy mix corresponds to the country average energy mix.

Carbon emissions from the combustion of fossil fuels are assumed to be constant in different countries. Their values are calculated from the International Energy Agency data (2016 Edition⁸) and equate to the values in the 2015 edition:

Gas	15.3 kgC/GJ = 0.202 kg CO ₂ /kWh
Oil	21.1 kgC/GJ = 0.279 kg CO ₂ /kWh
Coal	26.8 kgC/GJ = 0.354 kg CO ₂ /kWh
Biomass	0.201 kg CO ₂ /kWh ⁹

Carbon emissions from the electricity used in the real estate sector are related to the electricity production energy mix. It varies strongly among the European countries. Corresponding emission factors are also estimated from the International Energy Agency data.

Total consumption of electricity and heat in 2014¹⁰ was as follows¹¹:

Country	Electricity (ktoe)	Heat (ktoe)	Oil (ktoe)	Coal (ktoe)	Δ Total (TWh) yoy
Germany	44,104	9,148	53,252	619.3	-19.6
Netherlands	8,740	2,605	11,345	131.9	3.8
Poland	10,824	5,446	16,270	189.2	-4.0
France	35,718	2,217	37,935	441.2	-26.8
Czech Republic	4,833	2,164	6,997	81.4	0.5

ktoe = kilo ton of oil equivalent

Corresponding CO₂ emissions are available in the International Energy Agency database of CO₂ Emissions¹²:

Country	Electricity & Heat Production (mtCO ₂ /year)	Δ yoy
Germany	327.6	-14.7
Netherlands	58.3	4.3
Poland	148.3	-9.3
France	28.9	-14.1
Czech Republic	54.2	-1.9

The carbon intensity of the electricity and heat consumption is obtained by the following formula:

$$\text{Electricity \& Heat Carbon Intensity} = \frac{\text{CO}_2 \text{ Emissions of Electricity \& Heat Production}}{\text{Electricity \& Heat Total Consumption}}$$

The formula yields the following results for each country:

Country	Electricity & Heat Carbon Intensity (kgCO ₂ /kWh final)	Δ yoy
Germany	0.529	-0.007
Netherlands	0.442	0.021
Poland	0.784	-0.032
France	0.066	-0.026
Czech Republic	0.666	-0.027

The average of carbon intensities weighted by the energy mix of the real estate sector in the respective geographic region is as follows:

$$\text{RE Energy Mix Carbon Intensity} = \sum_{\text{Energy Mix}} \text{Carbon Intensity (Energy)} \times \text{Share (Energy)}$$

This gives the following factors that are essential for the impact report:

Country	kgCO ₂ / kWh final	Δ yoy
Germany	0.351	-0.003
Netherlands	0.302	0.009
Poland	0.542	-0.030
France	0.146	-0.013
Czech Republic	0.450	-0.015

- 1 The second party opinion can be downloaded at www.green-pfandbrief.com.
- 2 Published on <http://www.green-pfandbrief.com>.
- 3 See also Section D.4 and Appendix.
- 4 ENTRANZE, March 2014. Heating and cooling energy demand and loads for building types in different countries of the EU – D2.3. of WP2 of the Entranze Project.
http://www.entranze.eu/files/downloads/D2_3/Heating_and_cooling_energy_demand_and_loads_for_building_types_in_different_countries_of_the_EU.pdf
- 5 Used for all commercial properties in Berlin Hyp's carbon reporting, as ENTRANZE does not contain data for other commercial real estate than office buildings.
- 6 Economidou M., March 2012, Energy Performance Requirements for buildings in Europe, REHVA Journal.
<http://www.rehva.eu/fileadmin/hvac-dictio/03-2012/energy-performance-requirements-for-buildings-in-europe.pdf>
- 7 Kemna, R. and Moreno Acedo, J., August 2014, Average EU building heat load for HVAC equipment, Final Report.
https://ec.europa.eu/energy/sites/ener/files/documents/2014_final_report_eu_building_heat_demand.pdf
- 8 <http://www.entranze.enerdata.eu/#/total-unit-consumption-per-m2-in-non-residential-at-normal-climate.html>
- 9 IEA, 2016, Fuel Combustion Highlights – Carbon Content Values (kgC/GJ).
<http://www.iea.org/publications/freepublications/publication/co2-emissions-from-fuel-combustion-highlights-2016.html>
- 10 Source: http://www.eumayors.eu/IMG/pdf/technical_annex_en.pdf, from 0 kg CO₂/kWh (if wood is harvested in a sustainable manner) to 0.403 kg CO₂/kWh (if wood is harvesting in unsustainable manner). The mean value is considered in this case.
- 11 No more recent data are available.
- 12 The data are extracted from the IEA-HeadlineEnergyData 2016. <http://www.iea.org/statistics/>
- 13 www.iea.org/publications/freepublications/publication/CO2EmissionsfromFuelCombustion_Highlights_2016.pdf

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