stichting W/E adviseurs

W/E report 32266

Avoided CO_2 emissions Green Bond Portfolio ABN AMRO

Status per 31-12-2022

Stichting W/E adviseurs
Utrecht/Eindhoven, 17 October 2023

Avoided CO2 emissions
Green Bond Portfolio ABN AMRO

Status per 31-12-2022

Client
ABN AMRO Bank N.V.
Gustav Mahlerlaan 10
1082 PP Amsterdam
greenbonds@nl.abnamro.com

Contractor
W/E consultants
Jan van Hooffstraat 8E
5611 ED Eindhoven
Contact: mr. Pieter Nuiten
T +31 40 235 8450 | M +31 6 2239 6192 | E nuiten@w-e.nl
K.v.K. nr. S 41172371 | BTW nr. NL 00 48 41 554 B01 | Triodos nr. NL06 TRIO 0198 3526 11

Project
W/E 32266

Content

1 ABN AMRO Green Bond

As requested by ABN AMRO, W/E consultants have calculated the CO_2 impact indication of the assets that are financed by the outstanding ABN AMRO Green Bond portfolio[1] as per 31 December 2022. This report covers the impact calculations of the current ABN AMRO Green Bond portfolio, consisting of multi- and single-family-dwellings (project category A: energy efficient residential buildings), green loans for solar panels (project category B1), offshore wind energy (project category B2) and commercial real estate (CRE, project category C).

In this report the carbon impact is calculated per eligible asset category depending on the distribution of allocated assets per 31 December 2022. Core indicators are reported in accordance with the 'The Global GHG Accounting & Reporting Standard for the Financial Industry' of PCAF[2].

1.1 Total financed CO_2-emission ABN AMRO portfolio

The proceeds of the current green bond portfolio are allocated to the residential mortgages (A), the Green Loans (B1), offshore wind projects (B2) and the CRE selection project categories of ABN AMRO (C). For each of these categories, the annual avoided CO_2 emissions (for buildings compared to a national benchmark) have been calculated (Table 1). The calculated financed CO_2-emission reduction of the current ABN AMRO green bond portfolio is 120,968 tonnes CO_2 per year[3].

Table 1 Avoided financed CO_2-emissions portfolio ABN AMRO.

		Reduction [tonnes/a]
A	Residential buildings	-19,929
B1	Solar panels	-9,262
B2	Offshore wind	-90,940
C	CRE	-837
TOTAL		**-120,968**

The table on the following page gives a more detailed breakdown of the CO_2 impact per project category.

[1] https://www.abnamro.com/greenbonds, https://assets.ctfassets.net/1u811bvgvthc/9ZBk4K1DY1PNNbMcpLhgp/78b9e3cba540be27fef7462a789ab03c/ABN_AMRO_Green_Bond_issues_20221231.pdf

[2] PCAF (2020). 'The Global GHG Accounting and Reporting Standard for the Financial Industry/partA. Second edition', December 2022, https://carbonaccountingfinancials.com/files/downloads/PCAF-Global-GHG-Standard.pdf

[3] In this report, we use metric tonnes (1,000 kilograms).

Table 2 Reporting table in line with the ICMA Harmonised Framework for Impact Reporting[4].

Green Building Portfolios	Signed amount	Share of Total Project Financing	Eligibility for green bonds	Green Building Component	Allocated Amount	Average Portfolio lifetime	Nett Building Area	#1) Primary Fossil Energy Use			#2 Annual CO2 emissions avoided		
Portfolio name	mln euro	%	% of signed amount	% of signed amount	mln euro	year	in m²	kWh/m²	% of primary fossil energy use avoided	% of renewable energy generated on site	kg CO_2/m²	tonnes of CO_2	% of carbon emissions avoided
multi family houses	1.677	58%	100%	100%	970	10+	452.902	119	-44%	N/A	4,7	2.144	-31,2%
single family houses	7.131	67%	100%	100%	4.802	10+	2.687.883	121	-42%	N/A	6,6	17.785	-30,4%
Commerical Real Estate	184	59%	100%	100%	107	1,08	71.100	124	-42%	N/A	6,1	430	-14,6%
Total	**8.992**	**65%**	**100%**	**100%**	**5.879**		**3.211.885**	**121**	**-42%**	**N/A**	**6,3**	**20.359**	**-29,8%**

Renewable Energy (RE)	Signed Amount	Share of total project financing	Eligibility for green bonds	RE component	Allocated amount	Average Portfolio lifetime	#2 Annual generation		#3 Renewable energy capacity added	Renewable energy capacity rehabilitated	#1 Annual CO2 emissions avoided		
							electricity	other					
Portfolio name	mln euro	%	% of signed amount	% of signed amount	mln euro	year	MWh	GJ	MW	MW		tonnes of CO_2	
Green Loans	65	77%	100%	100%	51	12,5	31.939	-	36	-		9.262	
Off shore wind energy	10.204	2%	100%	100%	191	10+	313.585	-	3.510	-		90.940	
Total	**10.269**	**2%**	**100%**	**100%**	**241**		**345.524**	**-**	**3.546**	**-**		**100.202**	

Energy efficiency (EE)	Signed amount	Share of Total Project Financing	Eligibility for green bonds	EE component	Allocated Amount	Average Portfolio lifetime	#1 Annual energy savings				#2 Annual CO2 emissions reduced	
							electricity	other				
Portfolio name	mln euro	%	% of signed amount	% of signed amount	mln euro	year	MWh	GJ			tonnes of CO_2	
Commerical Real Estate	9	100%	100%	100%	9		N/A	N/A			407	
Total	**9**	**100%**	**100%**	**100%**	**9**		**0**	**0**			**407**	

Total	Signed amount	Share of Total Project Financing	Eligibility for green bonds		Allocated Amount						Annual CO2 emissions reduced / avoided	
Portfolio name	mln euro	%	% of signed amount		mln euro						tonnes of CO_2	
Total	**19.270**	**100%**	**100%**		**6.130**						**120.968**	

Residential buildings and CRE

The method for calculating the avoided CO_2-emissions of residential buildings and Commercial Real Estate (CRE) is described in paragraph 2.1.

Paragraph 2.2 gives the calculated CO_2-emissions of the energy efficient residential buildings within the ABN AMRO Green Building Portfolio. The calculated emissions are compared to the associated benchmark CO_2-emissions in paragraph 2.3. The Primary Fossil Energy Use as reported in Table 2 is calculated in a similar way, using Primary Fossil Energy Use numbers per energy label category.

Paragraph 5.1 gives the calculated CO_2-emissions of the CRE in the ABN AMRO portfolio. The calculated emissions are compared to the associated benchmark CO_2-emissions in paragraph 5.2.

The CRE portfolio consists of an Energy Efficiency part (which are the ABN AMRO owned buildings) and a Green Building Portfolio part.

The PCAF CO_2 coefficients and the distribution of the m^2 useful floor area of the average buildings in the Netherlands that are used as bases for the calculations for can be found in the Annex (6.1).

Renewable energy

The effect of the financed solar panels and offshore wind energy are calculated in the chapters 3 (solar panels) and 4 (offshore wind energy).

1.2 Characteristics ABN AMRO portfolio

The characteristics of the four categories are given in Table 3 (A. residential buildings), Table 4 (B1. solar panels), Table 5 (B2. offshore wind energy) and Table 6 (C. CRE).

[4] https://www.icmagroup.org/sustainable-finance/impact-reporting/green-projects/

Table 3 Project category A: Energy efficient residential buildings.

Use function	number of property units[5]	useful floor area [m²]	property value [mln. €]	current loan [mln. €]
Multi-family dwellings	3,969	452,902	1,677.4	970.5
Single-family dwellings	16,170	2,687,883	7,130.8	4,801.6
Total residential	**20,139**	**3,140,785**	**8,808.2**	**5,772.1**

Table 4 Project category B1 Renewable Energy – Green Loans solar panels.

Number of loans	6,018
Contract amount (mln. €)	65.2
Allocated amount (mln. €)	**50.5**

Table 5 Project category B2 Renewable Energy – Green Loans offshore wind farms.

Number of wind farms	6
Total project amount (debt + equity)[6] (mln. €)	10.204
Current drawn exposure / Outstanding amount (mln. €)	**191**
Share outstanding amount in total project amount	1.9%

Table 6 Project category C: Commercial real estate (CRE).

Use function	number of property units[4]	useful floor area [m²]	property value [mln. €]	current loan [mln. €]
Office	3	21,936	16	14
Shop	2	19,283	68	59
Multi-family dwellings	8	37,321	108	44
Healthcare	2	1,812	0.8	0.3
Total CRE	**21**	**80,352**	**193**	**117**

[5] In Dutch: 'verblijfsobject'.

[6] Equity + debt

2 Project category A Energy efficient residential buildings

2.1 Calculation method CO_2-emission buildings

The method for calculating the financed CO_2 emissions is derived from chapters '5.4 Commercial real estate' and '5.5 mortgages' of the PCAF publication[1].

The following calculations are made:

- The CO_2-emissions of the buildings in the ABN AMRO portfolio.
- The financed CO_2-emissions of these buildings. This is the calculated CO_2-emission per building multiplied by the attribution factor.
- Avoided emissions: The comparison of the (financed) CO_2-emissions to the benchmark, the average CO_2-emisions of a comparable set of Dutch buildings.

The annual CO_2-emission is calculated using CO_2 coefficients per use function per energy label G-A^{++++} (tonnes/m^2.a; see Table 21 in the Annex, taken from the PCAF database[7]) and the relevant data for all buildings in the ABN AMRO portfolio: use function (office, shop, dwellings), useful floor area [m^2] and the energy label. See formula [1] in the Annex.

The financed CO_2-emissions, as calculated according to formula [3] in the Annex, include the attribution factor in the calculations. The attribution factor is the ratio between the outstanding loan amount and the property value at origination, as calculated in formula [2] in the Annex. Per building the calculated CO_2-emisison is multiplied by the attribution factor of that building.

To compare the calculated CO_2-emissions to a benchmark, an average CO_2 coefficient [tonnes/m^2.a] per use function is calculated, using the average set of privately-owned dwellings in the Netherlands derived from WoON2018[8] and the average set of other use functions in the Netherlands as derived from the recent calibration for new energy labels of utility buildings in the Netherlands[9].

For the benchmark WoON2018 provides the useful floor area per dwelling. The corresponding energy labels of these dwellings have been calculated with NTA 8800:2022[10].

The calculations of the (financed) CO_2-emission reduction of the buildings in the ABN AMRO portfolio compared to the benchmark are made per building and then summed up per use function and then to a total.

Step-by-step

Calculations are made per building and then summed per use function and then total.

1. Collect the following data for all buildings in the ABN AMRO portfolio:
   - Use function[11]
   - Outstanding amount [euro]
   - Property value at origination [euro]
   - Attribution factor [%]
   - Energy label
   - Useful floor area [m^2]

[7] https://building-db.carbonaccountingfinancials.com/

[8] WoON2018: https://2018.woononderzoek.nl/jive/jivereportcontents.ashx?report=homenew

[9] Inijkingsstudie energielabels utiliteitsgebouwen, 2020: https://www.rijksoverheid.nl/documenten/publicaties/2020/04/29/advies-klassenindeling-energielabel-op-basis-van-nta-8800-voor-woningen-en-utiliteitsgebouwen

[10] NTA 8800 https://www.nen.nl/nta-8800-2022-nl-290717

[11] In Dutch: 'gebruiksfunctie'

2. Collect the CO_2 coefficients per m^2 useful floor area, per energy label from the PCAF website.
3. Use data from the first steps and the formulas of paragraph 6.3 in the Annex to calculate the CO_2-emission of the buildings in the ABN AMRO portfolio (results in chapter 2.2).
4. Calculate the average CO_2 coefficient [tonnes/m^2.a] per use function in the Netherlands using the average distribution of the m^2 useful floor area per energy label in the Netherlands and the PCAF CO_2 coefficients per use function and energy label. The average distribution of useful floor area over the energy labels comes from WoON2018 (dwellings) and the calibration for new energy labels of utility buildings in the Netherlands (other use functions).
5. Calculate the benchmark CO_2-emission per building, using the useful floor area of the building and the calculated average CO_2 coefficient for the corresponding use function. See paragraph 2.3.
6. Sum up all the calculated (financed) CO_2-emissions per building to the CO_2-emissions per use function and the total CO_2-emission.
7. The reduction is calculated to subtract the CO_2-emissions for the ABN AMRO portfolio from the CO_2-emissions of the average building set.

2.2 CO_2-emission residential buildings

The CO_2 emission of the residential buildings is calculated using data provided by ABN AMRO.

The calculation follows the method described in the previous chapter.

The distribution of useful floor area[12] in m^2 per use function and per energy label is given in Table 7. This format allows for an easy way of calculating the CO_2-emission, using the CO_2-emission per m^2 in Table 21 in the Annex.

Table 7 Cumulative useful floor area per use function and energy label for residential buildings [m^2].

Use function	A++++	A+++	A++	A+	A	Total
Multi-family	1,076	41,327	15,791	11,521	383,187	452,902
Single-family	14,417	234,305	27,099	30,578	2,381,484	2,687,883
Total residential	**15,493**	**275,632**	**42,890**	**42,099**	**2,764,671**	**3,140,785**

Table 8 gives the calculated CO_2 emissions of all buildings using the data from Table 7 (useful floor area in m^2) and Table 21 (CO_2 coefficient in tonnes/m^2.a).

Table 8 CO_2-emission for energy efficient residential buildings [tonnes/a].

Use function	A++++	A+++	A++	A+	A	Total
Multi-family	8	402	207	179	7,436	8,232
Single-family	122	2,663	426	578	56,790	60,579
Total residential	**130**	**3,064**	**633**	**758**	**64,226**	**68,811**

[12] In Dutch 'gebruiksoppervlakte'

Table 9 gives the financed CO_2-emission of the energy efficient residential buildings, which is calculated by multiplying the previously calculated CO_2-emission per residential building by the given attribution factor per building.

Table 9 Financed CO_2-emission for energy efficient residential buildings [tonnes/a].

Use function	A++++	A+++	A++	A+	A	Total
Multi-family	4	244	131	118	4,227	4,725
Single-family	86	1,770	288	389	38,282	40,815
Total residential	**90**	**2,013**	**419**	**507**	**42,509**	**45,539**

2.3 CO_2-emission compared to NL benchmark

The CO_2-emissions of the residential buildings in the ABN AMRO portfolio are compared with the average CO_2-emissions of residential buildings in the Netherlands, the associated benchmark. Calculations are made per building and then summed per use function and then for all residential buildings.

Table 10 gives the CO_2-emission compared to the Dutch benchmark.

Table 11 gives the financed CO_2-emission compared to the Dutch benchmark.

The basic principle of calculating the Dutch average CO_2-emissions is the same as used for the ABN AMRO portfolio (formula [1] in the Annex). The deciding parameters are the distribution of useful floor area of Dutch buildings per use function over the energy labels and the CO_2 coefficients per use function and energy label in the PCAF data.

In the Annex data are given of the distribution of useful floor area and the Dutch average CO_2 coefficients per use function (see Table 22 and Table 23 in the Annex).

For comparing the financed CO_2-emission of the buildings in the ABN AMRO portfolio to the benchmark, the calculated 'average' CO_2-emission per building is multiplied by the attribution factor per building (formulas [1], [3]).

Table 10 CO_2-emission of the residential buildings in the ABN AMRO portfolio, compared to a Dutch equivalent building stock with average CO_2 coefficients.

Use function	ABN AMRO CO_2-emission [tonnes/a]	Benchmark CO_2-emission [tonnes/a]	Reduction CO_2-emission [tonnes/a]
Multi-family	8,232	11,915	-3,683
Single-family	60,579	87,017	-26,438
Total residential	**68,811**	**98,932**	**-30,121**

Table 11 CO_2-emission reduction of the financed part of the residential buildings in the ABN AMRO portfolio compared to an equivalent Dutch average building stock.

Use function	ABN AMRO CO_2-emission [tonnes/a]	Benchmark CO_2-emission [tonnes/a]	Reduction CO_2-emission [tonnes/a]	Reduction CO_2-emission [%]
Multi-family	4,725	6,869	-2,144	-31.2%
Single-family	40,815	58,600	-17,785	-30.4%
Total residential	**45,539**	**65,468**	**-19,929**	**-30.4%**

3 Project category B1 Renewable Energy – Green Loans (solar panels)

Environmental aspects of solar panels used

On 1 January 2023, 6,018 loans for solar panels have been provided for a total contract amount of € 65 million. The allocated loan amount is € 51 million.

3.1 Methodology

Principle

The installed photovoltaic (PV) power for each of the loans is unknown, as is the actual electricity production. However, the information on the loan amount (in euro) is present, which can be used to make an estimate of the installed PV power per loan. In addition to this, we estimate the actual electricity production by using typical yields from scientific literature.

Table 12 Overview of portfolio Grean Loans (solar panels).

Overview	Eligible
Number of loans	6,018
Contract amount (euro)	65 million
Allocated amount (euro)	51 million

Calculation method

To calculate the total avoided CO_2-emissions, we transfer the loan amount via installed pv-power to estimated production:

- loan [euro] & installation costs [euro/Wp] → installed PV power [Wp]
- installed pv-power [Wp] & average production [kWh/kWp] → annual production [kWh]
- production [kWh/a] & specific CO_2-emission [kg/kWh] → avoided CO_2-emission [kg/a]

Installation costs in euro/Wp

The installed amount of power, expressed in Watt-peak (Wp) is derived from the installation cost per Wp. This number has changed significantly over the last few years, as can be seen in Figure 1 below and varies per year. The figure below is based on the 'Monitor Zon-PV 2022'[13], and recent cost developments on reports of Milieu Centraal[14]. The significant increase in cost for a PV installation, in contrast to the steady price decline of the past years, is explained by higher production and transport cost at a high PV system demand on the market.

[13] Monitor Zon-PV 2022 in Nederland, RVO, 14 July 2022. https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2022/09/30/monitor-zon-pv-2022-in-nederland/Monitor+Zon-PV+2022.pdf

[14] Milieu Centraal. https://www.milieucentraal.nl/energie-besparen/zonnepanelen/kosten-en-opbrengst-zonnepanelen/#zonnepanelen-nu-goedkoper

Figure 1 Historic costs of PV systems used in this assessment in euro/Wp, including VAT[13].

Average production in kWh per kWp

Using the total installed PV power, it is possible to calculate the annual energy production in kWh using the specific production in kWh/kWp. Because there is no data available on the yield of the included PV systems, we use the average specific production for all systems in The Netherlands. This number has been established at 875 kWh/kWp[15]. For the systems that were added in 2022, we use the recently updated standard for the specific production of building-bound PV installations, which is 900 kWh/kWp[16].

3.2 Impact indicator 1: Total energy production of solar panels installed

As a result, the calculated annual energy production for these systems is 31,939 MWh. In Table 13 below, the results of the calculations are presented.

Over the total expected life span of pv-systems of 25 years, the total predicted electricity production will be 798 GWh.

3.3 Impact indicator 2: Avoidance of CO_2 emissions related to these loans

The avoidance of CO_2 emissions is calculated based on the calculated electricity production per year and average carbon intensity of the Dutch energy mix.

There are different values of the carbon intensity in kg per produced kWh of electricity depending on different assumptions in the calculation method. For this assessment we use the emission factor derived from www.CO2emissiefactoren.nl. PCAF also refers to this source for the CO_2-emission per energy carrier. For 2022, the specific CO_2-emission is 0.29 kg/kWh, which is much lower than in 2021 due to a decrease in CO_2-emissions of the Dutch electricity grid. The total avoided CO_2-emissions due to the PV-loans within this bond are 9,262 tonnes per year.

Over the lifespan of 25 years, the avoided CO_2-emissions are approx. 232 thousand tonnes. The CO_2-emissions of the Dutch electricity grid will likely decline further in the future. However, reliable estimates are not available for this effect for the next 25 years.

[15] 29th European Photovoltaic Solar Energy Conference and Exhibition 2014, Update of the Dutch PV specific yield for determination of PV; https://www.seac.cc/wp-content/uploads/2016/11/7AV.6.43_paper.pdf

[16] Eindadvies basisbedragen SDE++ 2022, PBL report. Table 5.4; https://www.pbl.nl/sites/default/files/downloads/pbl-2022-eindadvies-sde-plus-plus-2022-4403.pdf

We therefore did not take these developments into consideration in our methodology and model but have used the 2022 numbers to extrapolate avoided CO_2-emissions.

Table 13 Installed power, electricity production and avoided CO_2-emission of the pv-systems.

Year of installation	kWp installed power		MWh prod	avoided CO_2-emission	
	per year	cumulative	cumulative	tonnes/a	kg/1000 €
2012	197	197	172		
2013	334	531	464		
2014	761	1,292	1,131		
2015	1,546	2,838	2,483		
2016	1,598	4,436	3,881		
2017	1,837	6,273	5,489		
2018	2,523	8,796	7,696		
2019	4,658	13,454	11,772		
2020	7,301	20,755	18,161		
2021	6,944	27,699	24,237		
2022	8,558	36,257	31,939	9,262	183
25 years (total)				**231,559**	

4 Project category B2 Renewable Energy - Offshore wind energy

Environmental aspects of wind turbine generators used

On 1 January 2023, green bond proceeds were allocated to six project finance loans for offshore wind farms with a total outstanding amount of € 190,886,180.

4.1 Methodology

In accordance to the PCAF guidelines, the P50 value of the expected annual energy yield is taken into account. The P50 value is the predicted annual production for which there is a 50% probability that it will be exceeded in a given year.

The installed power and P50 value for each of the loans is reported in technical due diligence reports, drafted by the Lenders Technical Advisors.

For each of the project, the total construction capital expenditures (CAPEX) is known as well. As ABN AMRO only provides part of the financing, the ABN AMRO share in the CAPEX is used to calculate the energy yield and avoided CO_2-emissions to be allocated to the Green Bond.

4.2 Impact indicator 1: Total energy production of wind turbine generators installed

The combined P50-values for the six wind farms is 15,635 GWh/a.

Over the total expected life span of wind turbine generators of 25 years, the total predicted electricity production will be 390,870 GWh.

The ABN AMRO share in the CAPEX of the project is on average 1.9%, resulting in 314 GWh/a to be allocated to these green bonds.

Table 14 Energy production wind turbines.

Number of windfarms	6
Share in CAPEX of project	1.9%
Combined P50-values (GWh/a)	15,635
Combined P50-values (GWh in 25 years)	390,870
Combined P50-values ABN AMRO share (GWh/a)	314

4.3 Impact indicator 2: Avoidance of CO_2 emissions related to these loans

The avoidance of CO_2 emissions is calculated on the basis of the calculated electricity production per year and average carbon intensity of the Dutch energy mix.

There are different values of the carbon intensity in kg per produced kWh of electricity depending on different assumptions in the calculation method. For this assessment we use the emission factor derived from www.CO2emissiefactoren.nl. For 2022, the specific CO_2-emission is 0.29 kg/kWh. PCAF also refers to this source for the CO_2-emission per energy carrier.

The total avoided CO_2-emissions due to the wind-loans within this bond (ABN AMRO share) are 90,940 tonnes per year. Over the lifespan of 25 years, the avoided CO_2-emissions are approx. 2.3 mln. tonnes. The CO_2-emissions of the Dutch electricity grid will likely further

decline in the future. However, reliable estimates are not available for this effect for the next 25 years. We therefore did not take these developments into consideration in our methodology. The current number for the specific CO_2-emission is used to calculate the avoided CO_2-emissions for the next 25 years.

Table 15 Installed capacity, electricity production (P50) and avoided CO_2 emission of the wind turbines, plus the total project amount (debt+equity) and the ABN AMRO current drawn exposure (outstanding amount), that results in the ABN AMRO share.

Nr	capacity	Project amount	current drawn exposure	share	P50	P50 ABN AMRO	avoided CO_2	avoided CO_2 ABN AMRO
	MW	mln €	mln €	%	GWh/a	GWh/a	tonnes/a	tonnes/a
1	600	2,800	62	2.2%	2,614	58	757,944	16,724
2	332	1,200	26	2.2%	1,222	27	354,235	7,775
3	288	1,300	3	0.2%	1,204	3	349,276	737
4	720	1,043	52	5.0%	2,713	136	786,857	39,561
5	370	807	26	3.2%	1,371	44	397,590	12,863
6	1,200	3,054	21	0.7%	6,511	46	1,888,190	13,281
TOTAL	**4,367**	**10,204**	**191**	**1.9%**	**15,635**	**314**	**4,534,092**	**90,940**

5 Project category C Commercial Real Estate (CRE)

The method for calculating the CO_2-emission of the CRE is given in paragraph 2.1.

5.1 CO_2-emission Commercial Real Estate (CRE)

The CO_2 emission of commercial real estate (CRE) is calculated using data provided by ABN AMRO. Energy label, useful floor area and use function were connected to the objects on the CRE list by using information from the Dutch energy label database.

In a specific group of objects (Bajeskwartier), it was not possible to retrieve the required parameters for a small number of utility objects. Those objects were left out from the calculation and this report. Different use functions were allocated to two other objects that have a 'Gathering' use function[17]. They changed into 'Retail' and 'Healthcare', as it is currently not possible to do the CO_2 and Primary Fossil Energy Use calculations for the 'Gathering' use function. For the residential objects that were not yet entered in the energy label database, numbers for useful floor area were provided and an energy label A++ was used, resulting from conservative judgement by ABN AMRO. In case the number of units per object in the CRE list was lower than the number of units found in the energy label database, the numbers for each energy label category were scaled down similarly.

The calculation follows the method described in the previous chapter.

The distribution of useful floor area[18] in m^2 per use function and per energy label is given in Table 16. This format allows for an easy way of calculating the CO_2-emission, using the CO_2-emission per m^2 in Table 21 in the Annex.

Table 16 Useful floor area per use function | energy label for CRE [m^2].

Use function	A+++	A++	A+	A	Total
Office	4,628			17,308	21,936
Retail	307			18,976	19,283
Multi-family dwellings	12,903	24,283	136		37,321
Healthcare	1,812				1,812
Total CRE	**19,649**	**24,283**	**136**	**36,284**	**80,352**

Table 17 gives the calculated CO_2 emissions of the CRE using the data from Table 16 (useful floor area in m^2) and Table 21 (CO_2 coefficient in tonnes/m^2.a).

[17] In Dutch 'bijeenkomstfunctie'

[18] In Dutch 'gebruiksoppervlakte'

Table 17 CO_2-emission the CRE within ABN AMRO portfolio [tonnes/a]

Use function	A+++	A++	A+	A	Total
Office	185			1,430	1,615
Retail	14			1,781	1,795
Multi-family dwellings	125	318	2		446
Healthcare	74				74
Total CRE	**398**	**318**	**2**	**3,211**	**3,930**

Table 18 gives the financed CO_2-emission of the CRE, which is calculated by multiplying the previously calculated CO_2-emission per CRE by the given attribution factor per building.

Table 18 CO_2-emission of financed part of the CRE within ABN AMRO portfolio [tonnes/a].

Use function	A+++	A++	A+	A	Total
Office	185			1,138	1,323
Retail	6			1,536	1,541
Multi-family dwellings	51	129	1		180
Healthcare	30				30
Total CRE	**271**	**129**	**1**	**2,674**	**3,075**

5.2 CO_2-emission compared to NL benchmark

The CO_2-emissions of the CRE in the ABN AMRO portfolio are compared to the average CO_2-emissions of CRE in the Netherlands, the associated benchmark. Calculations are made per building and then summed per use function and then for all CRE.

For comparing the financed CO_2-emission of the buildings in the ABN AMRO portfolio to the benchmark, the calculated 'average' CO_2-emission per building is multiplied by the attribution factor per building (formulas [1], [3]).

Table 19 gives the CO_2-emission compared to the Dutch benchmark.

Table 11 gives the financed CO_2-emission compared to the Dutch benchmark.

The basic principle of calculating the Dutch average CO_2-emissions is the same as used for the ABN AMRO portfolio (formula [1] in Annex 6.3). The deciding parameters are the distribution of useful floor area of Dutch buildings per use function over the energy labels and the CO_2 coefficients per use function and energy label in the PCAF data.

In the Annex data are given of the distribution of useful floor area and the average CO_2 coefficients per use function (see Table 22 and Table 23 in Annex 6.1 and 6.2 respectively).

For comparing the financed CO_2-emission of the buildings in the ABN AMRO portfolio to the benchmark, the calculated 'average' CO_2-emission per building is multiplied by the attribution factor per building (formulas [1], [3]).

Table 19 CO_2-emission of the CRE in the ABN AMRO portfolio, compared to a Dutch equivalent building stock with an average CO_2 emission.

Use function	ABN AMRO CO_2-emission [tonnes/a]	Benchmark CO_2-emission [tonnes/a]	Reduction CO_2-emission [tonnes/a]
Office	1,615	2,309	-694
Retail	1,795	1,749	+46
Multi-family dwellings	446	982	-536
Healthcare	74	204	-130
Total CRE	**3,930**	**5,243**	**-1,314**

Table 20 CO_2-emission of the financed part of the CRE in the ABN AMRO portfolio compared to a Dutch equivalent average building stock.

Use function	ABN AMRO CO_2-emission [tonnes/a]	Benchmark CO_2-emission [tonnes/a]	Reduction CO_2-emission [tonnes/a]	Reduction CO_2-emission [%]
Office	1,323	1,937	-614	-31.7%
Retail	1,541	1,495	+46	+3.1%
Multi-family dwellings	180	397	-217	-54.6%
Healthcare	30	83	-53	-63.7%
Total CRE	**3,075**	**3,912**	**-837**	**-21.4%**

6 Annex

6.1 CO_2-coefficients PCAF

PCAF has CO_2-emissions available for commercial real estate classes (use function) per energy label.

Table 21 CO_2 coefficients on PCAF website[19] (April 2023) [tonnes CO_2/m^2a].

	Single-family dwellings	Multi-family dwellings	Healthcare	Office	Retail
A++++	0,00846179	0,00746628		0,0300086	0,0340879
A+++	0,0113646	0,00971899		0,0399364	0,0453654
A++	0,0157187	0,0130981		0,0548282	0,0622816
A+	0,0189118	0,0155760		0,0657488	0,0746867
A	0,0238465	0,0194056		0,0826262	0,0938584
B	0,0287813	0,0232352		0,0995035	0,113030
C	0,0340063	0,0272901		0,117374	0,133329
D	0,0398118	0,0317955		0,137229	0,155884
E	0,0447466	0,0356251		0,154107	0,175056
F	0,0499716	0,0396800		0,171977	0,195355
G	0,0551966	0,0437349		0,189847	0,215655

6.2 Distribution m^2 useful floor area over energy labels & CO_2 coefficient NL

Table 22 The current distribution of m^2 useful floor area per use function over the energy labels in the Netherlands [% per use function]. Sources are WoON2018 (single-family dwellings and multi-family dwellings) and the calibration study[20] for energy labels (non-residential).

CRE	A++++	A+++	A++	A+	A	B	C	D	E	F	G
Office	0.1%	3.5%	13.9%	9.5%	20.9%	11.1%	12.6%	9.2%	4.9%	3.4%	11.0%
Retail	0.3%	11.1%	31.9%	15.5%	14.5%	7.0%	6.6%	4.5%	3.1%	2.3%	3.2%
Multi-family dwellings	0.0%	0.0%	0.3%	2.2%	35.5%	12.3%	22.4%	9.2%	7.7%	3.6%	6.8%
Single-family dwellings	0.2%	0.6%	1.0%	1.6%	19.1%	21.0%	35.6%	10.4%	6.0%	3.0%	1.4%

Table 23 Average CO_2-emission per use function [tonnes/m^2.a].

Combining Table 21 and Table 22 gives the average CO_2-emission per m^2 per use function.

Use function	CO_2-emission [tonnes/m^2.a]
Office	0.1052
Retail	0.0907
Multi-family dwellings	0.0263
Single-family dwellings	0.0324

[19] https://building-db.carbonaccountingfinancials.com/

[20] https://open.overheid.nl/repository/ronl-410b3d61-10db-4fd8-9512-f64bf063e6e1/1/pdf/Eindrapportage%20inijking%20energielabels%20utiliteit.pdf

6.3 Formulas

The following formulas are used to calculate the CO_2 emission of the buildings in the portfolio. All calculations have been done per building. Summed results per use function (and when necessary per energy label) are presented in the report.

[1] CO_2-emission = CO_2 coefficient PCAF * useful floor area
> CO_2 emission [tonnes CO_2/a]
> CO_2 coefficient PCAF, as given in Table 21 in the Annex [tonnes CO_2/m^2.a]
> useful floor area, as given in the ABN AMRO datasheets [m^2]

[2] Attribution factor = outstanding amount / property value at origination
> attribution factor, ratio between outstanding amount and property value at origination [-]
> outstanding amount, as found in the ABN AMRO data under 'current loan amount' [€]
> property value at origination, as can be calculated with the ABN AMRO data:
= 'loan amount at origination' / '% ABN AMRO financing' [€]

[3] Financed CO_2-emission = CO_2-emission * attribution factor
> Financed CO_2-emission, as the main result of the calculation [tonnes CO_2/a]