W/E rapport

Calculation of the avoided CO_2 emissions financed by the Green Bond Portfolio of ABN AMRO

Update 2020

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Project
W/E 30266

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1 Impact calculations ABN AMRO Green Bond

As requested by ABN AMRO, W/E consultants have calculated the CO_2 impact indication of the assets which are financed by the outstanding ABN AMRO Green Bond portfolio as per 1 January 2020. This report covers the impact calculations of the current EUR 2.5bn green bond portfolio, consisting of four outstanding green bonds with the following ISIN codes:

- XS1244060486 (EUR 500m, maturing in 2020)
- XS1422841202 (EUR 500m, maturing in 2022)
- XS1808739459 (EUR 750m, maturing in 2025)
- XS1982037696 (EUR 750m, maturing in 2026)

The process of finding the answers and the assumptions that have been made in that process will be discussed in the 'Methodology' section.

In this report we will calculate the energy use and carbon impact per eligible asset category with the allocation per bond depending on the distribution of allocated assets per 1 January 2020.

We will report on a number of core indicators in accordance with the 'harmonized framework for impact reporting' (version April 2020)[1] which is developed by a group of multilateral development banks including IFC, EIB, World bank and others[2].

Results

"The proceeds of the current green bond portfolio are allocated to four project categories of the ABN AMRO Green Bond Framework. For each of these categories, the annual average CO_2 savings (compared to a relevant national benchmark) have been calculated. For all assets within the green bond portfolio combined, the annual savings are about 190,000 tonnes[3] which corresponds to 76 kg per 1,000 euro. For each of the categories, the savings in tonnes per million euro are given in the table 2, table 5 and table 9.

Reporting table in line with harmonised framework

Green Building Portfolios	Signed amount	Share of Total Project Financing	Eligibility for green bonds	Green Building Component	Allocated Amount	Average Portfolio lifetime	Nett Building	#1) Primary Energy Use			#2 Annual CO2 emissions avoided		
Portfolio name	euro	%	% of signed amount	% of signed amount	euro	year	in m^2	kWh/m^2	% of energy use avoided	% of renewable energy generated on site	kg CO_2/m^2	tonnes of CO_2	% of carbon emissions avoided
Residential Mortgages	2,008,800,000	100%	100%	100%	2,008,800,000	10+	643,640	119	48%	N/A	18.2	13,059	53%
Commerical Real Estate	123,700,000	100%	100%	100%	123,700,000	2.88	62,678	140	50%	N/A	20.1	1,261	50%
Total	**2,132,500,000**	**100%**	**100%**	**100%**	**2,132,500,000**		**706,318**	**120**	**49%**	**N/A**	**18.4**	**14,319**	**52%**

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	euro	%	% of signed amount	% of signed amount	euro	year	MWh	GJ	MW	MW		tonnes of CO_2
Green Loans	38,432,047	100%	100%	100%	30,000,000	12.5	21,735	-	25	-		8,803
Off shore wind energy	330,400,000	100%	100%	100%	330,400,000	10+	408,629	-	4,649	-		159,298
Total	**368,832,047**	**100%**	**100%**	**100%**	**360,400,000**		**430,365**	**-**	**4,673**	**-**		**168,101**

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	euro	%	% of signed amount	% of signed amount	euro	year	MWh	GJ			tonnes of CO_2
Commerical Real Estate	7,100,000	100%	100%	100%	7,100,000	3.83	0	2,934			140
Total	**7,100,000**	**100%**	**100%**	**100%**	**7,100,000**		**0**	**2,934**			**140**

Total	Signed amount	Share of Total Project Financing	Eligibility for green bonds		Allocated Amount						Annual CO2 emissions reduced / avoided
Portfolio name	euro	%	% of signed amount		euro						tonnes of CO_2
Total	**2,508,432,047**	**100%**	**100%**		**2,500,000,000**						**182,560**

Note: Energy savings are given as savings in primary energy, not as energy consumption "on the meter".

[1] https://www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/Handbook-Harmonized-Framework-for-Impact-Reporting-220520.pdf

[2] http://treasury.worldbank.org/cmd/pdf/InformationonImpactReporting.pdf

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

2 Project category A Mortgage loans for energy efficient residential buildings

Achieved energy efficiency of buildings

ABN AMRO has selected 6,333 dwellings to be part of the green bond portfolio.

2.1 Methodology

Principle

Within this assessment, we determined the energy usage of the dwellings and compared this to the average Dutch dwelling. The energy usage is calculated using the energy performance method as depicted in the Dutch 'Building Decree 2012'. Even though there is a difference between calculated and actual energy use, especially when looking at a single building or dwelling, we are of the opinion that for a large portfolio of dwellings there is a good match between theory and practice for new dwellings[4].

For the Dutch average, we used the figures for 2018, the latest available data, from CBS, the Dutch Central Bureau for Statistics (see Table 11).

Energy Performance Coefficient

All new buildings in The Netherlands need to comply with an energy performance requirement, set by the Dutch 'Building Decree 2012'. This requirement is expressed in terms of the Energy Performance Coefficient ("EPC[5]"). We refer to Table 10 for more information on EPC requirements.

The EPC is an indicator for the primary energy performance of a building. This only comprises building related energy use for space heating and cooling, domestic hot water, ventilation, fans and lighting. It also takes renewable energy installations into account[6]. 'Primary' means that the energy demand of a dwelling within the EPC relates to the fossil energy demand. For electricity use, this means that the efficiency of the Dutch power production and power grid is taken into account (set at 39%[7] within the calculation method). For example, a dwelling with an electricity bill of 3,000 kWh will have a primary energy demand of 3,000/39% = 7,692 kWh. For natural gas, the efficiency of the grid (transportation, distribution) is set at 100%. So a dwelling with a gas bill of 1,000 m^3 will also have a primary gas demand of 1,000 m^3, which is equivalent (for Dutch gas) with 35.17 GJ[8] or 9.769 kWh.

[4] http://www.energievastgoed.nl/2013/02/otb-delft-energielabel-voorspelt-gasverbruik/?doing_wp_cron=1429005389.5604948997497558593750

[5] In international context, the abbreviation EPC may also refer to Energy Performance Contracting or Energy Performance Certificate, (which in the Netherlands is known as an 'energy label')

[6] More information can be found at http://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/wetten-en-regels-gebouwen/nieuwbouw/energieprestatie-epc/bepalingsmethode-epc.

[7] NEN 7120+C2/C3, C4, C5, "Energy performance of buildings -Determination method, 2012", table 5.4

[8] See for example http://www.rvo.nl/sites/default/files/2013/10/Heslinga%202006%20%28NL%29%20Vaststellingsmethodieken%20voor%20CO2%20emissiefactoren%20van%20aardgas%20in%20Nederland.pdf

Data dwellings with a loan from ABN AMRO

All allocated eligible loans were build according to the requirements in the 'Building Decree' and therefore have an Energy Performance Coefficient (EPC) of 0.4 (or lower). The EPC-requirement ≤ 0.4 came into effect on 1 January 2015. To make sure that all dwellings within the green bond portfolio meet this requirement and fulfil the criteria of the Dutch Building Decree, only mortgages are selected by ABN AMRO for which the date of the initial offer is minimum 24 months later than the entry date of this EPC requirements (so after 1 January 2017).

There is no detailed information available on the individual type and size of the dwellings. It is therefore assumed that the distribution of type and size of the 6,333 dwellings is equal to the average type and size of all new Dutch dwellings. Information on the average dwellings is used from 'Reference dwellings 2013' published by RVO[9].

Data average dwellings in the Netherlands

The average energy consumption of *privately owned* dwellings in the Netherlands[10] is about 3,250 kWh of electricity and 1,540 m^3 of natural gas (equivalent). The figure for natural gas has been corrected for weather conditions, as gas is mainly used for space heating. Roughly 5% of all Dutch dwellings has a connection to a district heating system. For this assessment, the use of district heating has been neglected.

Combination data ABN AMRO and average NL

We use dwelling data and the energy performance formula to calculate the primary energy usage for gas.

CO_2-emissions - natural gas

The CO_2 emissions[11] of Dutch natural gas are 1.78 kg/m^3 in line with PCAF.

CO_2-emissions - electricity

There are different values of the carbon intensity in kg per produced kWh of electricity depending on assumptions made in the calculation method. For this assessment we comply with the guidelines provided by PCAF[12], specifically their report from December 2019. PCAF refers to www.co2emissiefactoren.nl to determine the specific emission for each energy carrier. For electricity, we used 0.405 kg/kWh. This number includes CO_2-emissions related to transmission and distribution of electricity, but does not include upstream emissions (for winning and transport of fuels).

[9] https://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/wetten-en-regels-gebouwen/nieuwbouw/energieprestatie-epc/referentiewoningen-epc

10 https://klimaatmonitor.databank.nl/Jive?workspace_guid=d027664f-9cde-4f02-a4be-216499a7e983; screen dump in Annex

[11] https://www.rvo.nl/sites/default/files/2017/05/Berekening%20standaard%20CO2-emissiefactoren%20aardgas%20tbv%20nationale%20monitoring%202017%20en%20emissiehandel%202017.pdf

[12] PCAF = Platform Carbon Accounting Financials, http://carbonaccountingfinancials.com/

2.2 Impact indicator 1: Energy performance

Average energy consumption of residential buildings (in kWh/m^2) financed through the green bond portfolio compared to the average energy consumption of residential buildings in the Netherlands.

Table 1 Energy consumption ABN AMRO loans compared to average of Dutch residential buildings.

Energy consumption and CO2 emissions ABN AMRO loans compared to average of privately owned residential buildings in the Netherlands					
parameter	unit	average NL	ABN-AMRO	saving	% saving
number of dwellings = households (hh)	hh	6,333	6,333		
Energy performance coëfficiënt (EPC)	-		EPC = 0.40		
average user area	m2	102	102		
average loss area	m2	193	193		
average consumption electricity	kWh/hh.year	3,250	3,250		
	kWh/m2	32	32		
average consumption natural gas	m3/hh.year	1,540	381	1,159	-75%
	m3/m2.year	15.16	4	11	
	kWh/m2.year	148	37	111	
average consumption electricity + natural gas	kWh/m2.year	180	69	111	-62%
primary energy use	GJ/year	532,693	274,615	258,078	-48%
	MJ/m2.year	828	427	401	
	kWh/m2.year	230	119	111	

2.3 Impact indicator 2: CO_2 emissions performance

Average CO_2 emissions of residential buildings (in kg/m^2) financed through the loans compared to the average CO_2 emissions of residential buildings in the Netherlands (based on the carbon intensity of the Dutch energy mix). The savings are 13,000 tonnes CO_2 annually.

Table 2 CO_2 emissions ABN AMRO loans compared to average of Dutch residential buildings.

Energy consumption and CO2 emissions ABN AMRO loans compared to average of privately owned residential buildings in the Netherlands					
parameter	unit	average NL	ABN-AMRO	saving	% saving
number of dwellings = households (hh)	hh	6,333	6,333		
average emission CO_2	tonnes/year	24,786	11,728	13,059	-53%
	kg/hh.year	3,914	1,852	2,062	
	kg/m2.year	38.5	18.2	20.3	
	kg/keuro			6.50	

3 Project category B1 Renewable Energy - GreenLoans

Environmental aspects of solar panels used

On 1 January 2020, 3,760 loans for solar panels have been provided for a total contract amount of € 38,432,047. The allocated loan amount is somewhat lower, at € 30,000,000.

3.1 Methodology

Principle

The installed pv-power for each of the loans is unknown, as is the actual electricity production. However, we do have information on the loan amount (euro) which can be used to make an estimate of the installed pv-power per loan. Additional to this, we estimate the actual production by using typical yields from scientific literature [13].

Table 3 Overview of portfolio 'pv loans'

	Eligible
Number of loans	3,760
Contract amount [euro]	38,432,047
Allocated amount [euro]	30,000,000

Calculation method

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

loan in euro	&	installation costs in euro/Wp	→ installed pv-power in Wp
installed pv-power in Wp	&	average production in kWh / kWp	→ annual production in kWh
annual production in kWh	&	specific CO_2-emission per kWh	→ total avoided CO_2-emission

Installation costs in euro/Wp

The installed amount of power (watt-peak or Wp) is derived from the installation cost per Wp. This number has changed significantly over the last few years, as can be seen in Table 4 below and varies per year. We have used different sources to provide a reliable estimate of the installation costs per Wp. The figure below shows three sources:

- ECN studies on the SDE-subsidies (national subsidies on sustainable energy production units, based on the costs of the generated electricity; updated yearly);
- Market surveys conducted by the 'Solar electricity monitoring foundation' (update irregularly, from 2011 onwards);

Combining these three sources, an annual amount of installation costs per Wp has been determined. In Annex 2 Table 12 all used documents are listed.

[13] Van Sark et al, "Update of the Dutch pv specific yield for determination of pv contribution to renewable energy production: 25% more energy!", 29th European Photovoltaic Solar Energy Conference and Exhibition, September 2014 https://www.seac.cc/wp-content/uploads/2016/11/7AV.6.43_paper.pdf

Figure 1 Historic costs of pv-systems from different sources in euro/Wp, including VAT

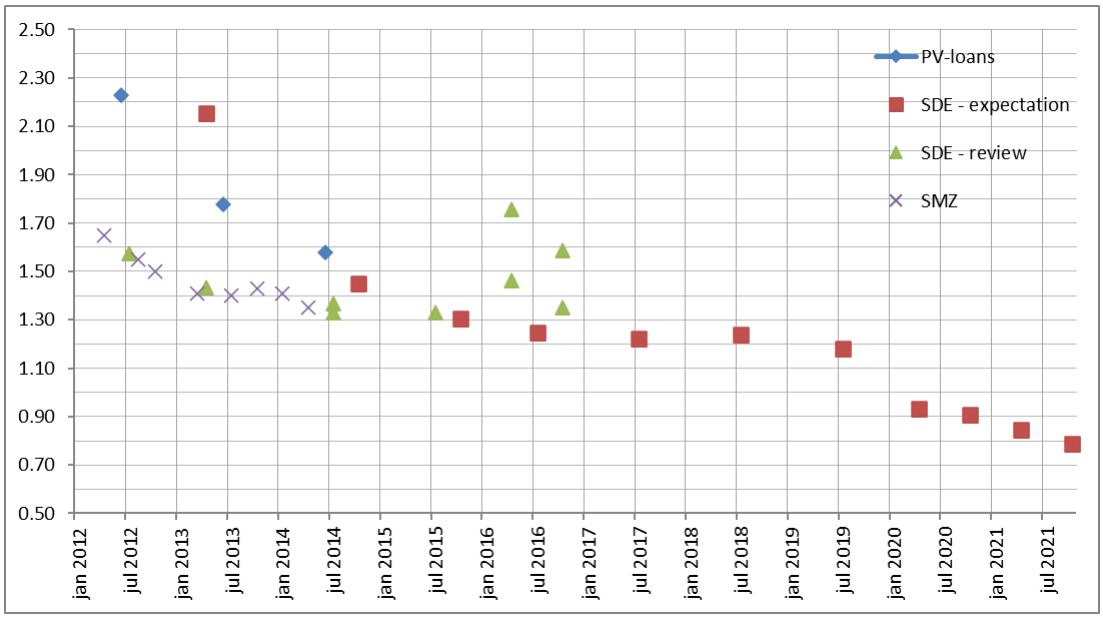

Table 4 Historic costs of pv-systems used in this assessment in euro/Wp, including VAT

Calculation values euro/Wp	
year	calc. value
-	euro/Wp
2012	1.60
2013	1.40
2014	1.35
2015	1.33
2016	1.67
2017	1.64
2018	1.66
2019	1.58

Average production in kWh / 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/Wp[14].

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

As a result, the calculated annual energy production for these systems is 21,735 MWh. In Table 5 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 543 GWh.

3.3 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.

[14] 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

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 same emission factor as outlined in paragraph 2.1 (PCAF 2018 - www.co2emissiefactoren.nl). For 2019, the specific CO_2-emission is 0.405 kg/kWh.

The total avoided CO_2-emissions due to the pv-loans within this bond are 8,800 tonnes per year. Over the lifespan of 25 years, the avoided CO_2-emissions are approx. 220 thousand tonnes. The CO_2-emissions of the Dutch electricity grid will likely 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 and model but have used the 2019 numbers to extrapolate avoided CO_2-emissions.

Table 5 Installed power, electricity production and avoided CO_2 emission of the pv-systems, and cumulative

Electricity production and avoided CO_2 emission

year of installation	installed power kWp/year install.year	installed power kWp cumulative	electricity production kWh/year install.year	electricity production MWh/year cumulative	Avoided CO_2 tonnes/year	Avoided CO_2 kg per thousand euro
2009	0	0	0	0		
2010	0	0	0	0		
2011	0	0	0	0		
2012	808	808	707	707		
2013	929	1,737	813	1,520		
2014	2,254	3,991	1,973	3,492		
2015	4,417	8,408	3,865	7,357		
2016	3,386	11,794	2,963	10,320		
2017	4,362	16,157	3,817	14,137		
2018	4,790	20,947	4,191	18,329		
2019	3,893	24,841	3,407	21,735	8,803	293
25 years				543,386	220,071	

4 Project category B2 Renewable Energy - Offshore wind energy

Environmental aspects of wind turbine generators used

On 1 January 2020, green bond proceeds were allocated to eight project finance loans for offshore wind farms with a total outstanding amount of € 330,408,545.

4.1 Methodology

In accordance to the PCAF[15] 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 CO2-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 eight wind farms is 20,176,000 MWh/a. Over the total expected life span of wind turbine generators of 25 years, the total predicted electricity production will be 504,388 GWh.

The ABN AMRO share in the CAPEX of the project is on average 1.9%, resulting in 409,000 MWh/a to be allocated to these green bonds.

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 same emission factor as outlined in paragraph 2.1 (PCAF 2019 – www.co2emissiefactoren.nl). For 2019, the specific CO_2-emission is 0.405 kg/kWh.

The total avoided CO_2-emissions due to the wind-loans within this bond (ABN AMRO share) are 159,298 tonnes per year. Over the lifespan of 25 years, the avoided CO_2-emissions are approx. 3,982 thousand tonnes. The CO_2-emissions of the Dutch electricity grid will likely 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 and model but have used the 2019 numbers to extrapolate avoided CO_2-emissions.

[15] PCAF = Platform Carbon Accounting Financials, http://carbonaccountingfinancials.com/

Table 6 Installed power, electricity production and avoided CO_2 emission of the wind-systems, and cumulative

Electricity production and avoided CO_2 emission			total						ABN AMRO sh	
#	nstalled capacity [MW]	electricity production (P50) [GWh/a]	Avoided CO_2 [tonnes/a]	CAPEX [euro]	CAPEX [euro/MW]	CAPEX [euro/MWh]	loans - contracted amount [euro]	ABN AMRO share	electricity production (P50) [GWh/a]	Avoided C [tonnes
1	600	2,614	1,058,508	2,346,109,000	3,910,182	36	80,518,820	3.4%	90	36,
2	332	1,222	494,708	969,100,000	2,918,097	32	47,173,704	4.9%	59	24,
3	288	1,204	487,782	1,285,000,000	4,461,806	43	21,977,887	1.7%	21	7,
4	252	1,100	445,500	1,064,542,422	4,224,375	39	39,004,939	3.7%	40	16,
5	857	3,441	1,393,484	2,328,013,240	2,715,676	27	24,974,751	1.1%	37	13,
6	732	2,713	1,098,887	1,329,000,000	1,816,541	20	27,725,787	2.1%	57	20,
7	370	1,371	555,255	969,172,000	2,622,219	28	45,816,482	4.7%	65	26,
8	1,218	6,511	2,636,955	6,993,000,000	5,741,379	43	43,216,175	0.6%	40	14,
total	4,649	20,176	8,171,078	17,283,936,662	28,410,274	267	330,408,545	1.9%	409	159,
25 years		504,388	204,276,938						10,216	3,982,

5 Project category C Commercial real estate loans for energy efficient building projects

Energy efficiency of buildings

This category comprises different portfolio's with offices, retail stores and commercially developed retail housing, both renovated and new. The portfolios contain existing office buildings, with a total usable floor area of about 25,000 m^2, existing shops (floor area 19,000 m^2) new shops (18,000 m^2) and new office buildings (13,000 m^2).

5.1 Methodology

Principle for new and existing buildings

For the buildings in this portfolio, actual energy consumption is not available. We therefore use calculated energy consumption based on the energy label of the buildings.

Calculated CO_2 emission of the buildings within the ABN AMRO portfolio are compared to the average CO_2 emission of Dutch offices, shops and dwellings. Calculations are based on the energy performance of the buildings, which includes the primary energy use. Because the CO_2 emission of 1 MJ of primary energy use for gas is slightly different than that for electricity, an assumption has been made to split the total energy consumption into gas and electricity consumption. The assumptions are that the building related electricity use is 35 kWh/m^2 in offices, 11 kWh/m^2 in retail housing and 90% of the total primary energy in retail shops[16].

New buildings

For the new buildings (shops, offices, retail housing) the building related primary energy consumption is calculated using the EPC formula in NEN 7120 / EPG (energy performance of buildings)[17]. The usable floor area and the required EPC result in the building related primary energy use.

Existing buildings

The CO_2 emissions of the renovated buildings will be calculated according to ISSO 75.3, which is the Dutch calculation method used to determine the energy label for existing buildings with a commercial building function.

For dwellings the average CO_2 emission has been determined in the chapter about 'Project category A', see 2.3.

The energy consumption of the offices and retail shops is calculated on the basis of the energy-index formula in ISSO 75.3 (calculation method for energy labels for existing commercial buildings). Per building the usable floor area (m^2) and the energy indicator (EI) of the buildings are used to calculate the building related primary energy use for heating, cooling, domestic hot water (dhw), ventilation and lighting. The additional energy consumption for usage of the building like computers, printers, et cetera is not taken into account.

[16] http://www.lente-akkoord.nl/wp-content/uploads/2014/01/WE-rapport-8504-Aanscherping-EPC-2015-eindrapport-versie-20-12-2013-.pdf

[17] NEN 7120+C2/C3, C4, C5, "Energy performance of buildings -Determination method, 2012"

Average energy consumption offices, shops and dwellings in the Netherlands

The average for offices and shops is calculated on the basis of the current distribution of energy labels, the number of energy labels A, the number of energy labels B, et cetera.

The energy label database of RVO provides the number of offices and retail stores per energy label in The Netherlands[18]. The database only includes the buildings which obtained an official energy label. We assume that the energy use of these buildings to be the average energy use of Dutch offices and retail stores. The calculated average energy-index (EI) for offices is 1.22 and for shops 1.02. These EI values are used to calculate the average primary energy consumption and are compared to the EI of buildings in the portfolio.

The calculated average primary energy consumption and resulting CO_2 emission of Dutch buildings can be found in Table 7. For comparison only the energy consumption and CO_2 emission per m^2 usable floor area will be used.

Table 7 Calculated primary energy consumption for average buildings in The Netherlands, same size as the new and existing buildings in the green bond portfolio's.

Average existing buildings NL

object type ABN AMRO	floor area	energy label	EI	EI	primary energy use		CO2	CO2
-	m2		-	-	kWh/m2	MJ/m2	kg/m2	tonnes
offices	12,967	C	1.22	1.22	197	709	33.7	438
retail shops	9,186	A	1.02	1.02	275	990	44.1	406

Energy upgrades

The CO_2 emissions of the buildings which have undergone an energy upgrade will be calculated according to ISSO 75.3, which is the Dutch calculation method used to determine the energy label for buildings with a non-residential building function. For most of the buildings there is also an estimation of involved consultants of the expected reduction of CO_2-emissions. These estimates have been used to calculate the reduction of the primary energy consumption.

[18] RVO database official energy labels, January 2019

5.2 Impact indicator 1: Energy performance

The energy labels of the existing offices are A or A+ with an energy index (EI)[19] at issuance that varies from 0.78 to 0.91. The new offices are assumed to follow the required EPC of 1.1 (office).

Table 8 below shows the primary energy consumption of the ABN AMRO portfolio compared to the average for The Netherlands. The energy consumption is given in GJ, MJ/m^2 and in kWh/m^2.

Table 8 Calculated primary energy consumption for new and existing buildings in the ABN AMRO portfolios.

New financing and existing buildings

object type	floor area	Average NL			Portfolio			Savings			
ABN AMRO	m2	kWh/m2	MJ/m2	GJ	kWh/m2	MJ/m2	GJ	kWh/m2	MJ/m2	GJ	relative
offices	25,934	197	709	18,398	114	412	10,676	83	298	7,722	-42%
retail shops	36,744	275	990	36,362	127	459	16,860	147	531	19,502	-54%
Total Portfolio	62,678	243	874	54,760	140	503	27,536	121	434	27,223	-50%

Energy upgrades

object type	floor area	before upgrade			after upgrade			Savings			
ABN AMRO	m2	kWh/m2	MJ/m2	GJ	kWh/m2	MJ/m2	GJ	kWh/m2	MJ/m2	GJ	relative
offices	12,483	206	741	9,253	141	506	6,319	65	235	2,934	-32%
Total Portfolio	12,483	206	741	9,253	190	683	6,319	65	235	2,934	-32%
Total Portfolio	75,161	237	852	64,013	125	450	33,855	111	401	30,157	-47%

With the chosen methodology the buildings in the portfolio save about 30,000 GJ primary energy (-47%) per year compared to the average Dutch buildings with the same commercial function.

5.3 Impact indicator 2: CO_2 emission performance

The CO_2-emission performance is calculated on the basis of the calculated primary energy consumption of the buildings and the CO_2-emission indicator 0.03917 kg/MJ$_{primary}$[20] for electricity and 0.506 kg/MJ$_{primary}$ for natural gas.

Table 9 Calculated CO_2-emissions in the ABN AMRO portfolios compared to average for The Netherlands.

New financing and existing buildings

object type	floor area	Average NL		Portfolio		Savings			Savings
ABN AMRO	m2	kg/m2	tonnes	kg/m2	tonnes	kg/m2	tonnes	relative	tonnes/Meuro
offices	25,934	33.7	875	18.7	485	15.1	391	-45%	12.4
retail shops	36,744	44.1	1,622	20.5	752	23.7	870	-54%	9.4
Total Portfolio	62,678	39.8	2,497	19.7	1,237	20.1	1,261	-50%	10.2

Energy upgrades

object type	floor area	before upgrade		after upgrade		Savings			Savings
ABN AMRO	m2	kg/m2	tonnes	kg/m2	tonnes	kg/m2	tonnes	relative	tonnes/Meuro
offices	12,483	35.4	441	24.1	301	11.2	140	-32%	19.7
Total Portfolio	12,483	35.4	441	24.1	301	11.2	140	-32%	19.7
Total Portfolio	75,161	39.1	2,939	20.5	1,538	18.6	1,401	-48%	10.7

With the chosen methodology the buildings in the portfolio save about 1,400 tonnes of CO_2 emission (-48%) per year compared to the average Dutch buildings with the same commercial function.

[19] http://wetten.overheid.nl/BWBR0020921/BijlageII/geldigheidsdatum_07-05-2015

[20] 0.405 kg/kWh$_{on\ the\ meter}$; www.co2emissiefactoren.nl (0.405 / 3.6 (MJ/kWh) * 0.39 (efficiency Dutch grid) = 0.04395
1.78 kg/m^3 natural gas equals 1.78 / (35.17 MJ/m^3) = 0.506 kg/MJ$_{primary}$

6 Annexes

6.1 EPC-requirements

Figure 2 Development of EPC-requirements per building type/ function[21]

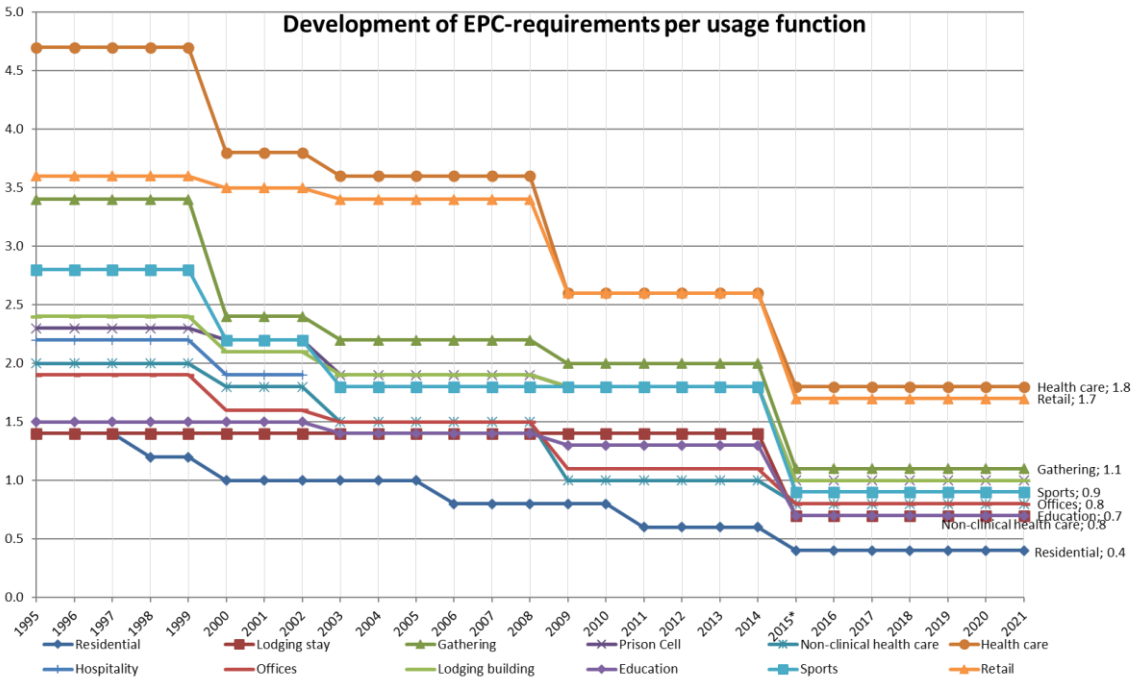

Table 10 Development of EPC-requirements per use function[21]

Figures in bold indicate a change in the requirements.

Gebruiksfunctie	Function	1995	1998	2000	2003	2006	2009	2011	2015
Woningen	Residential	1.4	**1.2**	**1.0**	1.0	**0.8**	0.8	**0.6**	**0.4**
Logiesverblijf	Lodging stay	1.4	1.4	1.4	1.4	1.4	1.4	1.4	**0.7**
Bijeenkomst	Gathering	3.4	3.4	**2.4**	**2.2**	2.2	**2.0**	2.0	**1.1**
Cel	Prison Cell	2.3	2.3	**2.2**	**1.9**	1.9	**1.8**	1.8	**1.0**
Gezondheidszorg niet klinisch	Non-clinical health care	2.0	2.0	**1.8**	**1.5**	1.5	**1.0**	1.0	**0.8**
Gezondheidszorg met bedgebied	Health care	4.7	4.7	**3.8**	**3.6**	3.6	**2.6**	2.6	**1.8**
Horeca	Hospitality	2.2	2.2	**1.9**	-	-	-	-	-
Kantoor	Offices	1.9	1.9	**1.6**	**1.5**	1.5	**1.1**	1.1	**0.8**
Logiesgebouw	Lodging building	2.4	2.4	**2.1**	**1.9**	1.9	**1.8**	1.8	**1.0**
Onderwijs	Education	1.5	1.5	1.5	**1.4**	1.4	**1.3**	1.3	**0.7**
Sport	Sports	2.8	2.8	**2.2**	**1.8**	1.8	1.8	1.8	**0.9**
Winkel	Retail	3.6	3.6	**3.5**	**3.4**	3.4	**2.6**	2.6	**1.7**
Industrie	Industry	-	-	-	-	-	-	-	-

[21] http://www.lente-akkoord.nl/wp-content/uploads/2014/01/WE-rapport-8504-Aanscherping-EPC-2015-eindrapport-versie-20-12-2013-.pdf

6.2 Average energy consumption Dutch households

Table 11 Average energy consumption Dutch Households

Gemiddeld - Nederland									
	2010	2011	2012	2013	2014	2015	2016	2017	2018
elektriciteitsgebruik alle woningen [kWh]	3.300	3.250	3.200	3.150	3.050	2.980	2.910	2.860	2.790
elektriciteitsgebruik huurwoningen [kWh]	?	?	?	2.450	2.350	2.300	2.260	2.210	2.180
elektriciteitsgebruik koopwoningen [kWh]	?	?	?	3.700	3.550	3.480	3.400	3.330	3.250
gasgebruik alle woningen (temperatuurgecorrigeerd) [m3]	1.620	1.570	1.480	1.450	1.410	1.340	1.320	1.310	1.330
gasgebruik huurwoningen (temperatuurgecorrigeerd) [m3]	?	?	?	1.230	1.180	1.100	1.070	1.070	1.050
gasgebruik koopwoningen (temperatuurgecorrigeerd) [m3]	?	?	?	1.680	1.650	1.580	1.550	1.550	1.540

Source: www.klimaatmonitor.databank.nl, July 2020,
https://klimaatmonitor.databank.nl/Jive?workspace_guid=b579871b-937b-48f7-aef6-6136885f0b5b

6.3 Costs of pv-systems

The table below lists all used references to establish an average cost for pv-systems in the period 2011-2019, as used for project category B. Costs are given in euro/Wp.

Table 12 Cost development Solar PV systems; prices in euro/Wp, including 21% VAT

Date	PV-loans	SDE - expectation	SDE - review	SMZ	Remarks	Source	Link
01-07-2011			2.50		voor 50 a 100 kWp	Eindadvies SDE+ 2012	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-E--11-054
apr-12				1.65	average flat/pitched roof		http://zonnestroom.ophetweb.nu/wp-content/uploads/2013/03/PVmarkt-april2012.pdf
jun-12	2.23						
01-07-2012			1.57		voor 100 kWp	Eindadvies SDE+ 2013	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-E--12-038
aug-12				1.55	average flat/pitched roof		http://zonnestroom.ophetweb.nu/wp-content/uploads/2013/03/PVmarkt-aug2012.pdf
okt-12				1.50	average flat/pitched roof		http://zonnestroom.ophetweb.nu/wp-content/uploads/2013/04/Marktinventarisatie-
mrt-13				1.41	average flat/pitched roof		http://www.zonnestroomnl.nl/wp-content/uploads/2013/10/Marktinventarisatie-maart-
01-04-2013		2.15			voor 50 a 100 kWp	Eindadvies SDE+ 2012	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-E--11-054
01-04-2013			1.43		100 kWp	Eindadvies SDE+ 2014	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-E--13-050
jun-13	1.78						
jul-13				1.40	average flat/pitched roof		http://www.zonnestroomnl.nl/wp-content/uploads/2013/11/Marktinventarisatie-juli-
okt-13				1.43	average flat/pitched roof		http://www.zonnestroomnl.nl/wp-content/uploads/2014/03/Marktinventarisatie-
jan-14				1.41	average flat/pitched roof		http://www.zonnestroomnl.nl/wp-content/uploads/2014/07/markt-inventarisatie-
apr-14				1.35	average flat/pitched roof		http://www.zonnestroomnl.nl/wp-content/uploads/2014/08/markt-apr2014def.pdf
jun-14	1.58						
01-07-2014			1.37		100 kWp	Eindadvies SDE+ 2015	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-E--14-035
01-07-2014			1.33		250 kWp	Eindadvies SDE+ 2016	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-E--15-052
01-10-2014		1.45			100 kWp	Eindadvies SDE+ 2013	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-E--12-038
01-07-2015			1.33		250 kWp	Eindadvies SDE+ 2017	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-E--16-040
01-10-2015		1.31			100 kWp	Eindadvies SDE+ 2014	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-E--13-050
01-04-2016			1.75		15-30 kWp	Kostenonderzoek zonne-energie SDE+ 2018	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-N--17-012
01-04-2016			1.46		15-1000 kWp	Kostenonderzoek zonne-energie SDE+ 2018	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-N--17-012
01-07-2016		1.25			100 kWp	Eindadvies SDE+ 2015	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-E--14-035
01-10-2016			1.59		15-30 kWp	Kostenonderzoek zonne-energie SDE+ 2018	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-N--17-012
01-10-2016			1.35		15-1000 kWp	Kostenonderzoek zonne-energie SDE+ 2018	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-N--17-012
01-07-2017		1.22			250 kWp	Eindadvies SDE+ 2016	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-E--15-052
01-07-2018		1.24			250 kWp	Eindadvies SDE+ 2017	https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-E--16-040
01-07-2019		1.18				Eindadvies SDE+ 2018	https://www.pbl.nl/sites/default/files/downloads/eindavies_sde_2018.pdf
01-04-2020		0.93			250 kWp	Eindadvies basisbedrag SDE+ 2019	https://www.pbl.nl/sites/default/files/downloads/pbl-2018-eindadvies-basisbedragen-SDE-plus-
01-10-2020		0.91			250 kWp	Eindadvies basisbedrag SDE+ 2019	https://www.pbl.nl/sites/default/files/downloads/pbl-2018-eindadvies-basisbedragen-SDE-plus-
01-04-2021		0.85			250 kWp	Eindadvies basisbedragen SDE++	https://www.pbl.nl/sites/default/files/downloads/pbl-2020-eindadvies-basisbedragen-sde-plus-plus-
01-10-2021		0.79			250 kWp	Eindadvies basisbedragen SDE++	https://www.pbl.nl/sites/default/files/downloads/pbl-2020-eindadvies-basisbedragen-sde-plus-plus-