W/E report

CO_2-emission calculations for the inaugural Green Bond of ABN-AMRO

answers to energy related questions in Green Bond Framework for the inaugural Green Bond of ABN AMRO NV

W/E 8825
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Project
W/E 8825

Sinds 1979 betrouwbaar als adviseur voor een duurzame omgeving
W/E adviseurs zet zich in voor opdrachtgevers die streven naar een duurzame ontwikkeling van de gebouwde omgeving. We onderhouden duurzame relaties met overheden, vastgoedbeheerders, ontwikkelaars, corporaties, architecten en kennisinstituten. W/E is voor hen een meedenkende en kritische partner.
Ons werkterrein is breed en strekt zich uit van planadvies, onderzoek en instrumentontwikkeling tot beleid en implementatie. Plannen maken, kennis inbrengen, onderzoek doen, instrumenten ontwikkelen, beleid vormgeven en mensen motiveren. Onze inhoudelijke expertise stemmen we voortdurend af op de behoeften en ontwikkelingen in de markt. Zo blijven wij scherp en u ook.

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1 Impact calculations ABN AMRO Green Bond

As requested by ABN AMRO, W/E consultants has provided input and answers on energy related questions to formulate the Green Bond Framework which is put together in co-operation with oekom research. In addition, W/E consultants have developed a model to provide a CO_2 impact indication of the assets which will be incorporated in the Green Bond.

The next chapters contain the relevant questions and W/E has provided answers and opinions based on best practices and our experience. The process of finding the answers and the assumptions that have been made in that process will be discussed in the 'Methodology' section.

Results

Within the green bonds, three different project categories can be distinguished. For each of these categories, the annual CO_2 savings (compared to a relevant national benchmark) have been calculated. For all assets within the green bond combined, the annual savings are a bit below 8,700 ton.

Total CO2 savings, in ton

category	per year
Category A - residential dwellings	2.436
Category B - pv loans	3.558
Category C - commercial real estate	2.687
Total	8.680

Project category A
Mortgage loans for energy efficient residential buildings

A.1. Achieved energy efficiency of buildings

Methodology

ABN AMRO has selected 1,057 dwellings to be part of this Green Bond. Within this assessment, we determined the energy usage of these 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[a].

For the Dutch average, we used data from CBS, the Dutch Central Bureau for Statistics.

EPC

All new buildings in The Netherlands need to comply with a energy performance requirement, set by the Dutch 'Building Decree 2012'. This requirement is expressed in terms of the Energy Performance Coefficient ("EPC"). We refer to Table 5 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. More information can be found at http://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/energieprestatie/regelgeving/bepalingsmethode.

'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% 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[b] or 9,769 kWh.

Data dwellings with a loan from ABN AMRO

All eligible loans were build according to the requirements in the 'Building Decree 2012' and therefore have an Energy Performance Coefficient (EPC) of 0,6 (or lower).

There is no detailed information available on the type and size of the dwellings. It is therefore assumed that the distribution of type and size of the 1,057 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[c].

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

[b] NEN 7120+C2, Energy performance of buildings -Determination method, 2012

[c] http://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/energieprestatie-nieuwbouw-epn/ontwerpen/referentiewoningen-nieuwbouw

Data average dwellings in the Netherlands

The average energy consumption of *privately owned* dwellings in the Netherlands[d] [e] is about 3,700 kWh of electricity and 2,000 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, but in newly built areas this percentage is significantly lower. 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[f] of Dutch natural gas are 56.4 kg/GJ or 1.78 kg/m^3.

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 use the same method as ABN AMRO applies in its Annual Sustainability Report, which is assured by KPMG. These figures (also specifically for The Netherlands) are provided by the UK Department for Environment, Food and Rural Affairs[g].

For 2014, the specific CO_2-emission is 0,404 kg/kWh. This number does not include CO_2-emissions related to transmission and distribution of electricity.

Percentage of residential buildings that obtained an Energy Performance Certificate by NL Agency with a minimum energy performance labelled „A“ (on a scale from G-A)

All residential buildings built in 2006 are required to make an EPC calculation which should be below a value of 0.8. All these buildings will have an energy label “A”. The formal calculation method is described in "Rekenmethodiek definitief energielabel inclusief indeling energielabelklassen (versie 1.2)". The document "Tabellen met referenties inclusief labelklasse per referentie (versie 2.0)" shows that all buildings within the bond have an A-label. Figure 1 shows a copy of the relevant part of this document.

Given the EPC requirements in the Building Decree 2012, the dwellings within the Green Bond have an energy performance coefficient that is least 25% lower (= better) than the requirement for obtaining an energy label 'A'.

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[d] http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=81528NED&D1=a&D2=0,6-7&D3=0&D4=a&HDR=T&STB=G1,G2,G3&VW=T

[e] http://www.klimaatmonitor.databank.nl/quickstep/QsBasic.aspx; screen dump in Annex

[f] http://www.rvo.nl/sites/default/files/2014/08/Zijlema%202013%20Berekening%20CO2-emissiefactor%20aardgas%20jaar%202014.pdf

[g] http://www.ukconversionfactorscarbonsmart.co.uk/.

Figure 1 *Energy labels for each reference dwelling, including building period (copy of "Tabellen met referenties inclusief labelklasse per referentie (versie 2.0)"*

Labelklassen per referentie

De labelklassen zijn berekend met 'Rekenmethodiek definitief energielabel', versie 1.2 d.d. 16 september 2014
Bij het type flat/appartement is in tabel 3 uitgegaan van het subtype 'tussen midden', de meest voorkomende variant.
Voor de maisonnette is dat het subtype 'tussen dak' tot bouwjaar 1992, vanaf bouwjaar 1992 'hoek dak'.
In tabel 4 zijn de labelklassen opgenomen van alle subtypen.

WONINGTYPE **(C)**		BOUWPERIODE **(J)**									
		T/M 1945	1946-1964	1965-1974	1975-1982	1983-1987	1988-1991	1992-1999	2000-2005	2006-2013	2014 en later
		J1	***J2***	***J3***	***J4***	***J5***	***J6***	***J7***	***J8***	***J9***	***J10***
Vrijstaande woning		G	F	D	C	C	B	B	B	A	A
Twee / één kapwoning		G	F	D	C	C	C	B	B	A	A
Rijwoning hoek		G	F	D	C	C	C	B	B	A	A
Rijwoning tussen		F	E	C	C	C	C	B	A	A	A
Meergezinswoning	Flat/appartement*	G	E	E	B	C	C	C	B	A	A
	Maisonnette**	F	E	C	B	C	C	A	A	A	A

Tabel 3 *Labelklasse per woningtype en bouwperiode*

All relevant documents are available at RVO at request[h].

Impact indicator 1: Energy performance

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

Figure 2 *Energy consumption and CO_2 emissions ABN AMRO loans compared to average of Dutch residential buildings.*

parameter	unit	average NL	ABN-AMRO	saving	% saving
number of dwellings = households (hh)	hh	1,057	1,057		
Energy performance coëfficiënt (EPC)	-		0.60		
average user area	m2	102	102		
average loss area	m2	193	193		
average consumption electricity	kWh/hh.year	3,700	3,700		
	kWh/m2	36	36		
average consumption natural gas	m3/hh.year	2,000	705	1,295	-65%
	m3/m2.year	20	7	13	
	kWh/m2.year	192	68	125	
average consumption electricity + natural gas	kWh/m2.year	229	104	125	-54%
primary energy use	GJ/year	110,392	62,254	48,138	-44%
	MJ/m2.year	1,028	580	448	
	kWh/m2.year	286	161	125	

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).

Figure 3 *Energy consumption and CO_2 emissions ABN AMRO loans compared to average of Dutch residential buildings.*

parameter	unit	average NL	ABN-AMRO	saving	% saving
number of dwellings = households (hh)	hh	1,057	1,057		
Energy performance coëfficiënt (EPC)	-		0.60		
average user area	m2	102	102		
average loss area	m2	193	193		
average emission CO_2	ton/year	5,342	2,906	2,436	-46%
	kg/hh.year	5,054	2,750	2,304	
	kg/m2.year	49.7	27.1	22.7	

[h] www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/energielabel-installatiekeuringen/publicaties/energielabel/methodiek

Project category B
"Green Loans" for installation of solar panels on residential buildings

B.1. Environmental aspects of solar panels used

Methodology

In the period 1 January 2012 - 31 March 2015 there have been 1,625 loans for solar panels, for a total contract amount of € 13,759,073. The outstanding loan amount is somewhat lower, at €12,033,652

There is no information available in the ABN AMRO systems on the installed pv-power for each of the loans, nor of 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.

Calculation method

To calculate the total avoided CO2-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	→ yearly production in kWh
yearly 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 1 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);
- We have checked the above with a sample from the loan data (14 loans per year, 42 in total).

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

Figure 4 *Historic costs of pv-systems from different sources in euro/Wp, including VAT*

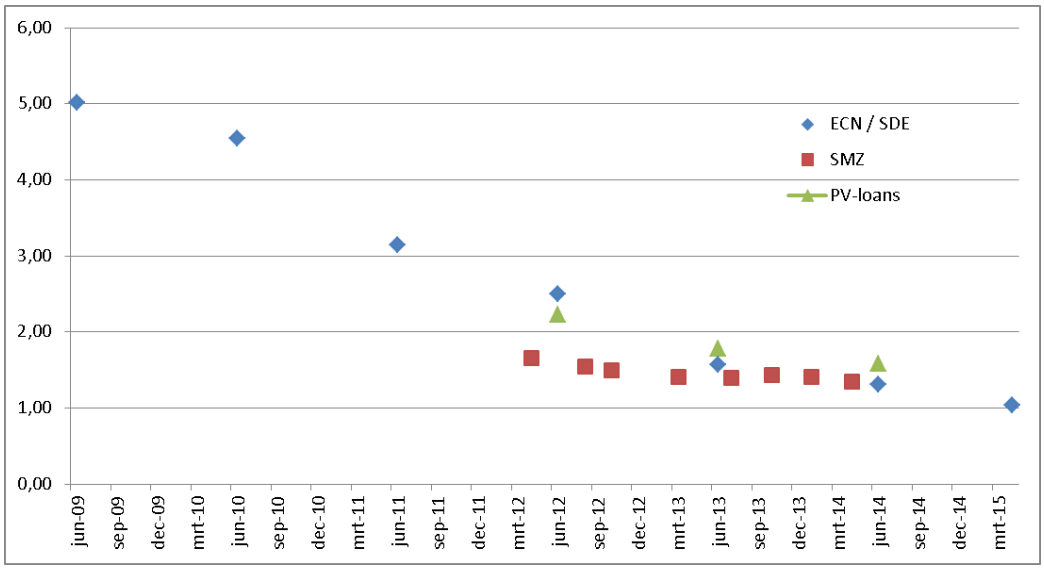


Table 1 *Historic costs of pv-systems used in this assessment in euro/Wp, including VAT*

Calculation values euro/Wp	
year	calc. value
-	euro/Wp
2012	1,60
2013	1,40
2014	1,35
2015	1,15

Average production in kWh / kWp

Using the total installed pv-power, it is possible to calculate the annual energy production in kWh using the average production in kWh/kWp. This number has been established at 875 kWh/Wp[i].

Impact indicator 1: Total energy production of solar panels installed

Calculated energy production

As a result, the calculated energy production in the year 2014 is 8,806,194 kWh. In Table 2 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 slightly over 220 million kWh.

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 method as ABN AMRO applies in its Annual Sustainability Report, on which assurance is provided by KPMG. Figures (also specifically for The Netherlands) are provided by the UK Department for Environment, Food and Rural Affairs[j].

[i] 29th European Photovoltaic Solar Energy Conference and Exhibition 2014, Update of the Dutch PV specific yield for determination of PV

[j] http://www.ukconversionfactorscarbonsmart.co.uk/.

For 2014, the specific CO_2-emission is 0,404 kg/kWh. This figure does not include CO2-emissions related to transmission and distribution of electricity.

The total avoided CO_2-emissions due to the pv-loans within this bond are 3,557,703 kg per year. Over the lifespan of 25 years, the avoided CO_2-emissions are approx. 89 million kg. In this figure, 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 2014 numbers to extrapolate avoided CO_2-emissions.

Table 2 Installed power, electricity production and avoided CO_2 emission of the pv-systems, and cumulative

Electricity production and avoided CO_2 emission

year	loans - contracted amount		installed power		electricity production	Avoided CO_2
	euro/year install.year	euro cumulative	Wp/year install.year	Wp cumulative	kWh/year cumulative	kg/year cumulative
2012	2.855.490	2.855.490	1.784.681	1.784.681	1.561.596	630.885
2013	2.844.732	5.700.222	2.031.951	3.816.633	3.339.553	1.349.180
2014	5.900.329	11.600.551	4.370.614	8.187.246	7.163.841	2.894.192
2015	2.158.522	13.759.073	1.876.976	10.064.222	8.806.194	3.557.703
25 years					220.154.859	88.942.563

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

This category comprises different portfolio's with offices, retail stores and commercially developed retail housing, both renovated and new. The portfolio's contain seven office buildings in total with a total usable floor area of 106,324 m^2, twelve retail shops with a total usable floor area of 74,958 m^2 and three projects with 6,543 m^2 of retail housing.

The energy labels of the existing offices and retail shops are A or A+ with an energy index (EI)[k] that varies from 0.55 to 1.04. The two new offices will be built in 2015 and 2016 and are assumed to follow the required EPC of 1.1.

The apartment buildings in the existing portfolio's are built in 2013 and are assumed to have an EPC of 0,6, which is in line with requirements of the Dutch Building Decree 2012.

C.7. Energy efficiency of buildings

Methodology

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 buildings with a commercial building function. The CO_2 emissions of the retail housing and the new to build offices will be calculated according to NEN 7120, which is the method for calculating the EPC.

The calculated CO_2 emission will compared to the average CO_2 emission of Dutch offices, shops and dwellings. This average will be 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.

For dwellings the average CO2 emission has been determined in the chapter about 'Project category A', see Figure 3.

Quantitative indicator: Percentage of residential buildings that comply with the Dutch Building Decree 2012 (Bouwbesluit 2012: Chapter 5 and NEN 1068) and meet the requirement of the building's insulation effectiveness above 3.5 m^2K /W (Rc-value for roofs, walls and floors). For example, the Rc-value of 3.5 m^2K/W for an exterior wall approximately equals a U-value of 0.27 W/m^2K.

All buildings need to comply with the 'Building Decree', the version which was valid at the day the building permit was requested. The mentioned[l] Rc-levels are valid for new buildings as well as for 'major conversions' (possibly only at component level). For smaller renovations, a minimum Rc-value of 1.3 m^2 K/W is required for the components that are affected by the renovation. For example, if façade insulation is added, the minimum Rc-value must be 1.3. If the façade is completely removed and renewed, the Rc-value must be at least 3,5. 'Major conversions' are defined in the EPBD recast, article 2: http://ec.europa.eu/energy/en/topics/energy-efficiency/buildings

There are no restrictions on the U-values of doors and windows when renovating[m].

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

[l] Per 1 January 2015, the Rc-requirements for floor, facades, roofs are 3.4 / 4.5 / 6.0 respectively.

[m] More information can be found at http://www.answersforbusiness.nl/regulation/building-regulations.

Impact indicator 1: Energy performance

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 is 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.

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

Average energy consumption offices and shops in the Netherlands

The energy label database of RVO provides the number of offices and retail stores per energy label in The Netherlands[o]. 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 shops. The calculated average energy-index (EI) for offices is 1,34 and for shops 1,13. These EI values are used to calculate the average primary energy consumption and are compared to the EI of buildings in the pool.

The average for dwellings is calculated in a previous chapter.

Calculated primary energy consumption

The calculated primary energy consumption of the buildings in the portfolio can be found in Table 3. The energy consumption is given in MJ, MJ/m^2 and in kWh/m^2.

The calculated average primary energy consumption of Dutch buildings can be found in Table 4. For comparison only the energy consumption and CO_2 emission per m^2 usable floor area will be used.

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 0,0438 $kg/MJ_{primary}$[p] for electricity and 0,506 $kg/MJ_{primary}$ for natural gas. 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[q].

[n] NEN 7120+C2, Energy performance of buildings -Determination method, 2012

[o] RVO database official energy labels, April 2015

[p] 0,404 $kg/kWh_{on\ the\ meter}$; Defra

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

Table 3: Calculated primary energy consumption and CO_2 emission per building in the ABN AMRO portfolio's.

object type	building function	floor area	EI	CO2-emission		primary energy use		
		m2	-	g/m2	kg	kWh/m2	MJ/m2	MJ
offices	office	10,158	0.95	25,830	262,422	154	554	5,624,149
offices	office	8,927	0.95	25,940	231,529	154	556	4,960,545
offices	office	20,803	0.95	25,460	529,567	152	546	11,362,629
offices	office	18,202	0.96	25,800	469,598	154	553	10,065,336
offices	office	13,387	0.95	25,730	344,437	153	552	7,384,212
retail stores	shop	13,773	0.89	38,330	527,914	239	861	11,859,727
retail stores	shop	4,463	0.77	33,970	151,614	212	763	3,406,059
retail stores	shop	5,594	0.89	38,990	218,086	243	876	4,899,360
retail stores	shop	13,976	1.03	44,350	619,856	277	996	13,925,231
retail stores	shop	206	1.04	49,680	10,234	310	1,116	229,919
retail stores	shop	467	0.99	47,290	22,086	295	1,062	496,166
retail stores	shop	5,299	0.64	28,080	148,790	175	631	3,342,608
retail stores	shop	1,608	1.03	48,290	77,647	301	1,085	1,744,352
retail stores	shop	9,930	0.55	23,790	236,276	148	535	5,308,004
retail stores	shop	16,323	0.68	29,230	477,154	182	657	10,719,389
retail stores	shop	1,986	0.83	38,230	75,923	239	859	1,705,636
retail stores	shop	1,333	0.73	34,870	46,485	218	783	1,044,306
			EPC					
retail housing	dwelling	3,723	0.60	15,430	57,435	88	318	1,185,518
retail housing	dwelling	2,820	0.60	15,370	43,340	88	317	894,733
offices	office	21,597	1.10	15,690	338,816	98	353	7,627,093
offices	office	13,250	1.10	15,970	211,561	100	359	4,752,303

Conclusion

The calculated primary energy use and CO_2-emissions are compared to the average energy consumption and CO_2-emissions of offices, shops and dwellings in the Netherlands.

With the chosen methodology the buildings in the portfolio save about 56,000 GJ primary energy (-33%) and about 2,700 tons of CO_2 emission (-34%) per year compared to the average Dutch buildings with the same commercial function.

The total results and per commercial function can be found in Table 4.

Table 4: Calculated primary energy consumption and CO_2 emission for the portfolio and the Dutch average.

object type	building function	floor area	CO2-emission			primary energy use			
		m2	kg/m2	kg		kWh/m2	MJ/m2	MJ	
PORTFOLIO Commercial Real Estate Loans - Energy consumption & CO2 emission									
offices	office	106,324	22.5	2,387,929		135	487	51,776,266	
retail shops	shop	74,958	34.9	2,612,064		217	783	58,680,757	
retail housing	dwelling	6,543	15.4	100,775		88	318	2,080,251	
TOTAL Portfolio		187,825		5,100,768				112,537,274	
Average NL									
offices	office		36.9			214	772		
retail shops	shop		49.6			309	1,113		
retail housing	dwelling		23.0			130	467		
PORTFOLIO Commercial Real Estate Loans compared to NL - Savings on energy consumption and CO2 emission reduction									
offices	office	106,324	-14.4	-1,534,255	-39%	-79	-285	-30,316,633	-37%
retail shops	shop	74,958	-14.7	-1,102,632	-30%	-92	-331	-24,777,631	-30%
retail housing	dwelling	6,543	-7.6	-49,727	-33%	-41	-149	-976,324	-32%
TOTAL Portfolio		187,825		-2,686,614	-34%			-56,070,588	-33%

2 Annexes

EPC-requirements

Figure 5 Development of EPC-requirements per use function[r]]

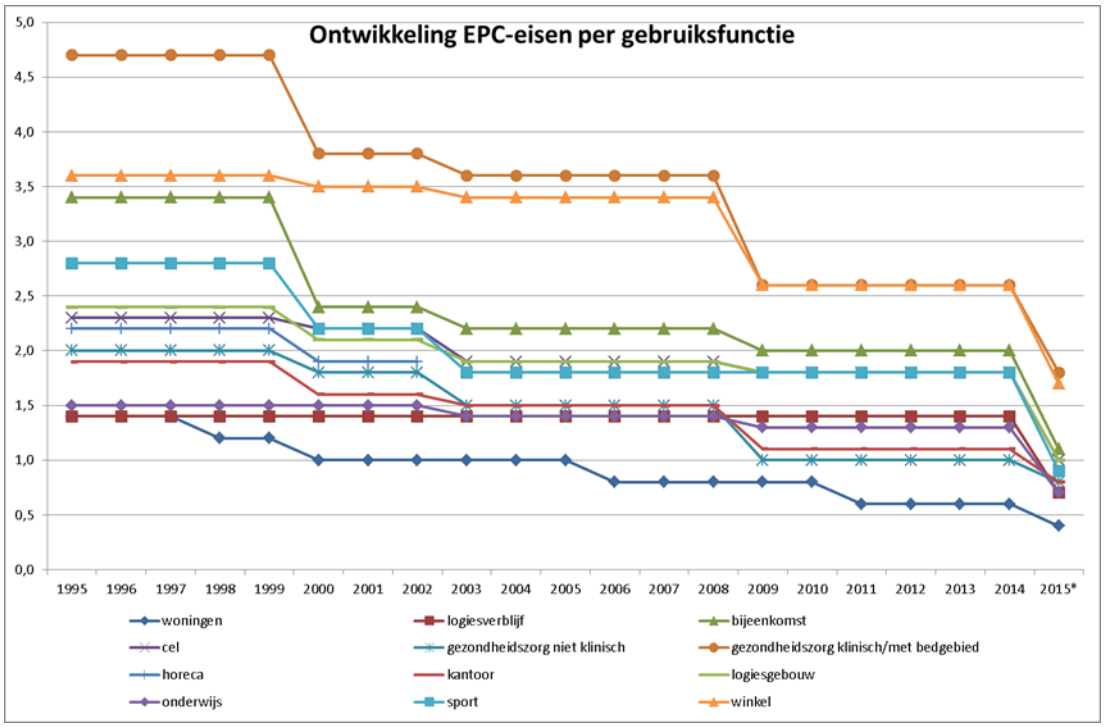


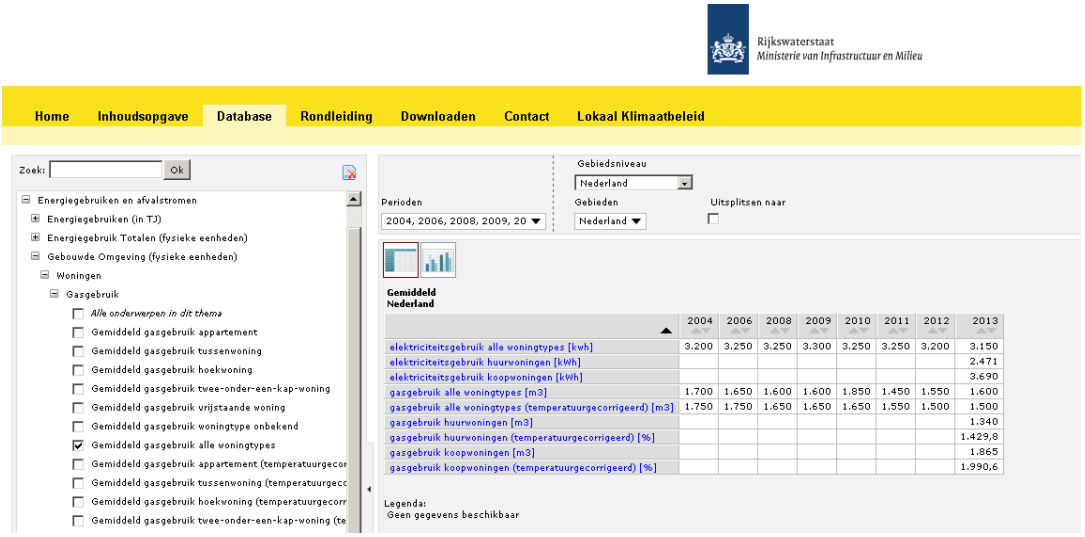
Table 5: Development of EPC-requirements per use function[r]

Figures in blue and bold indicate a change in the requirements.

gebruiksfunctie	1995	1998	2000	2003	2006	2009	2011	2015
woningen	1,4	**1,2**	**1,0**	1,0	**0,8**	0,8	**0,6**	**0,4**
logiesverblijf	1,4	1,4	1,4	1,4	1,4	1,4	1,4	**0,7**
bijeenkomst	3,4	3,4	**2,4**	**2,2**	2,2	**2,0**	2,0	**1,1**
cel	2,3	2,3	**2,2**	**1,9**	1,9	**1,8**	1,8	**1,0**
gezondheidszorg niet klinisch	2,0	2,0	**1,8**	**1,5**	1,5	**1,0**	1,0	**0,8**
gezondheidszorg met bedgebied	4,7	4,7	**3,8**	**3,6**	3,6	**2,6**	2,6	**1,8**
horeca	2,2	2,2	**1,9**	-	-	-	-	-
kantoor	1,9	1,9	**1,6**	**1,5**	1,5	**1,1**	1,1	**0,8**
logiesgebouw	2,4	2,4	**2,1**	**1,9**	1,9	**1,8**	1,8	**1,0**
onderwijs	1,5	1,5	1,5	**1,4**	1,4	**1,3**	1,3	**0,7**
sport	2,8	2,8	**2,2**	**1,8**	1,8	1,8	1,8	**0,9**
winkel	3,6	3,6	**3,5**	**3,4**	3,4	**2,6**	2,6	**1,7**
industrie	-	-	-	-	-	-	-	-

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

Average energy consumption Dutch households



	2004	2006	2008	2009	2010	2011	2012	2013
elektriciteitsgebruik alle woningtypes [kwh]	3.200	3.250	3.250	3.300	3.250	3.250	3.200	3.150
elektriciteitsgebruik huurwoningen [kWh]								2.471
elektriciteitsgebruik koopwoningen [kWh]								3.690
gasgebruik alle woningtypes [m3]	1.700	1.650	1.600	1.600	1.850	1.450	1.550	1.600
gasgebruik alle woningtypes (temperatuurgecorrigeerd) [m3]	1.750	1.750	1.650	1.650	1.650	1.550	1.500	1.500
gasgebruik huurwoningen [m3]								1.340
gasgebruik huurwoningen (temperatuurgecorrigeerd) [%]								1.429,8
gasgebruik koopwoningen [m3]								1.865
gasgebruik koopwoningen (temperatuurgecorrigeerd) [%]								1.990,6

Source: www.klimaatmonitor.databank.nl

Costs of pv-systems

The table below lists all used references to establish an average cost for pv-systems in the period 2011-2015, as used for project category B. Costs are given in euro/Wp.

Date	PV-loans	ECN / SDE	SMZ	Remarks	Source
jun-09		5,02		0,6 - 15 kWp	http://www.zonnekrachtcentrales.nl/assets/files/files/SDE%20basisbedragen%20%28advies%29%20%20e08090.pdf
jun-10		4,54		0,6 - 15 kWp	http://www.ecn.nl/docs/library/report/2009/e09058.pdf
jun-11		3,14		1-15 kWp	http://www.ecn.nl/docs/library/report/2010/e10082.pdf
okt-11				average flat/pitched	http://zonnestroom.ophetweb.nu/wp-content/uploads/2013/03/PVmarkt-okt2011.pdf
apr-12			1,65	average flat/pitched	http://zonnestroom.ophetweb.nu/wp-content/uploads/2013/03/PVmarkt-april2012.pdf
jun-12	2,33	2,50		50 a 100 kWp	http://www.ecn.nl/docs/library/report/2011/e11054.pdf
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-oktober-2012.pdf
mrt-13			1,41	average flat/pitched roof	http://www.zonnestroomnl.nl/wp-content/uploads/2013/10/Marktinventarisatie-maart-2013.pdf
jun-13	1,67	1,57		100 kWp	http://www.ecn.nl/docs/library/report/2012/e12038.pdf
jul-13			1,40	average flat/pitched roof	http://www.zonnestroomnl.nl/wp-content/uploads/2013/11/Marktinventarisatie-juli-2013.pdf
okt-13			1,43	average flat/pitched roof	http://www.zonnestroomnl.nl/wp-content/uploads/2014/03/Marktinventarisatie-oktober-2013.pdf
jan-14			1,41	average flat/pitched roof	http://www.zonnestroomnl.nl/wp-content/uploads/2014/07/markt-inventarisatie-jan2014.pdf
apr-14			1,35	average flat/pitched roof	http://www.zonnestroomnl.nl/wp-content/uploads/2014/08/markt-apr2014def.pdf
jun-14	1,42	1,31		100 kWp	https://www.ecn.nl/publicaties/ECN-E--13-050, http://geothermie.nl/fileadmin/user_upload/documents/bestanden/SDE/SDE2014_ECN_Eindavies_31_okt_2013.pdf