Alternative approach
Article 5
Energy Efficiency Directive

M. Menkveld

B. Jablonska

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Responsibility

This report has been commissioned by the Dutch Ministry of the Interior. The contact person for this project was Ms. K. Wattel-Meijers This project has been allocated project number 52056 within ECN. The ECN contact person is Marijke Menkveld (menkveld@ecn.nl).

Abstract

Article 5 of the Energy Efficiency Directive (EED) is an annual obligation to renovate 3% of the building stock of central government. After renovation the buildings will meet the minimum energy performance requirements laid down in Article 4 of the EPBD. The Directive gives room to an alternative approach to achieve the same savings. The Ministry of the Interior has asked ECN to assist with this alternative approach. ECN calculated what saving are achieved with the 3% renovation obligation under the directive. Then ECN looked for the possibilities for an alternative approach to achieve the same savings.

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Summary

Article 5 of the Energy Efficiency Directive (EED) contains an annual obligation to renovate 3% of the building stock of the central government. After renovation these buildings need to meet the minimum energy performance requirements as laid down in Article 4 of the Energy Performance of Buildings Directive (EPBD) by the Member State. The obligation refers to buildings owned and used by the central government with a usable floor area larger than 500 m2, and as of July 2015 it also includes floor areas of more than 250 m2. These are buildings owned by the Government Buildings Agency: offices of government departments, courthouses, buildings of customs and police and prisons. With regard to Defence buildings, only offices and barracks are under the obligation. The Directive allows an alternative approach to realise the same energy savings. The Dutch Ministry of the Interior and Kingdom Relations has asked ECN to research the effect on energy savings of the 3% renovation obligation in accordance with the Directive and to explore the options of an alternative approach to achieve the same savings.

ECN has received building stock data from the Government Buildings Agency and Defence. However, these data do not give a complete overview of the national building stock that is covered by the directive. Nevertheless, it is estimated that over 90% is included, which is sufficient to answer the research question.

Which saving is realised by the 3% renovation obligation?
The minimum energy performance requirements for existing buildings from the EPBD are translated into an Energy Index (EI): for offices the EI is 1.54 (label E), for prisons this is 1.57 (label E) and for alloy buildings it amounts to 1.65 (label F). Currently, 2.1 million square meters of usable floor area do not meet the requirements. An annual 3% renovation of the building stock to the level of the EPBD requirements means that a total of more than 400 000 m2 must be renovated in the period 2014-2020. The realized energy saving amounts to 219 TJ (0.2 PJ), assuming that buildings with an energy label G are renovated first.

An alternative approach
The options for an alternative approach are based on an analysis conducted by DHV in 2011 on request of the Government Buildings Agency. The DHV study outlines the potential savings on the basis of different scenarios, ranging from the use of sustainable procurement criteria, optimisation and tuning of energy installations to the deployment of Energy Service Companies and Energy Performance Contracting. These scenarios provide a savings potential of hundreds of terajoules, which is much more than the renovation obligation required.

If the buildings of the Government Buildings Agency should be renovated to meet the minimum energy performance requirements of the EPBD, this means an energy saving of 30% for each building. With a renovation pace of 3% per year this means a 1% energy saving per year for the entire portfolio. In case of 2% energy savings per year, in accordance with government policy, the Government Buildings Agency amply meets the obligation. The total gas and electricity consumption of all buildings of the Government Buildings Agency amounts more than 5 000 TJ. In the period 2014-2020, the objective of 2% energy saving a year means energy savings of 14% amounting to 700 TJ.

The Real Estate Department of Defence has been implemented the Energy Performance Advice project for some years now. For all the heated Defence Buildings built before 1999 and with a net floor area larger than 1 000 m2. Defence has already developed an Energy Performance Advice. The implementation of the recommended energy saving measures from this EPA approach involves a EUR 65 million investment in the period 2009 to 2019. These investments lead to potential savings of 600 TJ, while the average payback period of the package of measures is 7 years. For a total of 2.7 million m2 of usable floor area of buildings, an Energy Performance Advice is supplied. However, this applies to all types of buildings, whereas the selection of the offices and barracks that not meet the EPBD energy performance requirements is slightly less than half of the total. The potential energy savings for this selection, based on the EPA approach, is estimated to be approximately 300 TJ. Further roll-out of the EPA approach is sufficient for the Defence building stock to achieve the objective.

Conclusions

The analysis in this report shows that it is definitely possible to achieve the required savings in the framework of the obligation to renovate 3% of the national building stock, in accordance with Article 5 of the Energy Efficiency Directive, through an alternative approach. In fact, if the Government Buildings Agency continues the realisation of 2% energy savings per year through sustainable procurement, optimising and tuning of energy installations or the deployment of Energy Service Companies and energy performance contracting, this will be sufficient. The Ministry of Defence can continue the realisation of the recommended energy saving measures from the Energy Performance Advice approach in existing office buildings and barracks. In the implementation of the Directive, there are also options to differentiate and choose between the real estate portfolio of the Government Buildings Agency and of the Ministry of Defence.

Summary

Article 5 of the Energy Efficiency Directive (EED) contains an obligation to renovate 3% of the building stock of the central government each year. After renovation, this 3% of the building stock must meet the minimum energy performance requirements laid down by the Member State pursuant to Article 4 of the Energy Performance of Buildings Directive (EPBD)[1]. The obligation relates to buildings owned and used by central government with a usable floor area[2] larger than 500 m^2; as of July 2015 it also includes floor areas of more than 250 m^2. These are buildings owned by the Government Buildings Agency [*Rijksgebouwendienst*]: offices of government departments, courthouses, customs and police buildings and prisons. With regard to Ministry of Defence buildings, only offices and barracks are covered by the obligation. The Directive allows an alternative approach to be pursued in order to realise the same energy savings. The Dutch Ministry of the Interior asked ECN to assist in fleshing out this alternative approach. This initially means determining what saving can be achieved by means of the 3% renovation obligation laid down by the Directive. It is then necessary to explore the options for an alternative approach which enables at least the same savings to be achieved.

ECN has received building stock data from the Government Buildings Agency and the Ministry of Defence. However, these data do not give a complete overview of the national building stock that is covered by the Directive. Nevertheless, it is estimated that over 90% is included, which is sufficient to answer the question underlying the study.

[1] Article 4 of the Energy Performance of Building Directive (EPBD) is concerned with the establishment by EU Member States of the minimum energy performance requirements of new and existing buildings. The Ministry of the Interior has established minimum requirements for existing buildings and incorporated them into the Building Decree [*Bouwbesluit*]. The requirements for existing buildings also apply to major renovations.

[2] The Directive uses the term ‘useful floor area’, which ECN has translated into Dutch as ‘gebruiksoppervlakte’.

What saving is achieved by the 3% renovation obligation?

The minimum energy performance requirements for existing buildings from the EPBD are converted into an Energy Index (EI): for offices the EI is 1.54 (label E), for prisons 1.57 (label E) and for barracks 1.65 (label F). Currently, 2.1 million m2 of usable floor area do not meet the requirements. An annual 3% renovation of the building stock to the level of the EPBD requirements means that more than 400 000 m2 must be renovated in the period 2014-2020. The realised energy saving amounts to 219 TJ (0.2 PJ), assuming that buildings with an energy label G are renovated first.

An alternative approach

ECN has based the options for an alternative approach for the Government Buildings Agency on an analysis commissioned by the latter and carried out by DHV in 2011[3]. The DHV study outlines the potential savings on the basis of different scenarios, ranging from the use of sustainable procurement criteria, optimisation and tuning of energy installations to the deployment of energy service companies (ESCOs) and energy performance contracting. For offices, the possibility of reducing the stock has also been examined, whereby buildings with a poor label would be disposed of more quickly. These scenarios give rise to potential savings for the real estate of the Government Buildings Agency of hundreds of terajoules, which is much more than is required by the renovation obligation.

If the buildings of the Government Buildings Agency were renovated to meet the minimum energy performance requirements stemming from the EPBD, this would mean an energy saving of 30% for each renovated building. With a renovation rate of 3% per year, this means a 1% energy saving per year for the entire portfolio. In the context of the Directive, this means much less than a 1% energy saving per year because it is not necessary to renovate 3% of the entire portfolio but only 3% of that portion which does not meet the minimum energy performance requirements of the EPBD.[4] With a 2% energy saving per year, in line with government policy, the Government Buildings Agency amply meets the required saving to be achieved under Article 5 of the EED with a renovation of 3% of the government building stock. The total gas and electricity consumption of all buildings of the Government Buildings Agency is more than 5 000 TJ[5]. Over the period 2014-2020, the objective of a 2% energy saving per year means an overall energy saving of 14%, or 700 TJ.

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[3] DHV, 2011: '*Rijksgebouwendienst portefeuilleanalyse energetische kwaliteit 2011 Kantoren en penitentiaire inrichtingen*' *[2011 Energy quality review of the Government Buildings Agency portfolio - Offices and prisons]*, December 2011.

[4] Of all of the Government Buildings Agency's buildings with an energy label (2.4 million m2 in total useful floor area), 33% (approx. 800 000 m2) do not comply with the energy performance requirements of the EPBD.

[5] http://overheid.nl/media/downloads/JaarrapportageBedrijfsvoeringRijk2012.pdf

The Defence Buildings Agency [*Dienst Vastgoed van Defensie*] has been implementing the Energy Performance Advice (EPA) project for a number of years. Energy performance advice has now been developed for all heated Ministry of Defence buildings built before 1999 and with a net floor area larger than 1 000 m2. The implementation of the recommended energy saving measures resulting from this EPA approach involves a EUR 65 million investment in the period 2009 to 2019. These investments lead to potential savings of 600 TJ, while the average payback period of the package of measures is 7 years. Ministry of Defence buildings receiving energy performance advice totalling 2.7 million m2 in useful floor area have been examined. All types of buildings are covered, whereby the selection of the offices and barracks that do not meet the EPBD energy performance requirements for existing buildings is slightly less than half of the total. The potential energy savings for this selection as a result of EPA measures is estimated to be approximately 300 TJ. Further roll-out of the EPA approach is therefore sufficient for the real estate of the Ministry of Defence to meet the target.

Conclusions

The analysis in this report shows that it is definitely possible to achieve the required savings resulting from the obligation to renovate 3% of the national building stock, in accordance with Article 5 of the Energy Efficiency Directive, through an alternative approach. As an alternative approach, it is sufficient for the Government Buildings Agency to continue achieving 2% energy savings per year through sustainable procurement, optimising and tuning of energy installations or the deployment of ESCOs and energy performance contracting, and for the Ministry of Defence to continue implementing the recommended energy saving measures resulting from the EPA approach in existing office buildings and barracks larger than 1 000 m^2. In implementing the Directive, it is also still possible to make choices between the real estate portfolio of the Government Buildings Agency and of the Ministry of Defence.

1
Introduction

1.1 Background

Article 5 of the Energy Efficiency Directive (EED) contains an annual obligation to renovate 3% of the building stock of the central government. After renovation these buildings must meet the minimum energy performance requirements as laid down for the Member State in question pursuant to Article 4 of the Energy Performance of Buildings Directive (EPBD). The obligation relates to buildings owned and used by central government with a usable floor area[6] larger than 500 m^2; as of July 2015 it also includes floor areas of more than 250 m^2. The Directive allows an alternative approach to be pursued in order to realise the same energy savings. The Dutch Ministry of the Interior asked ECN to assist in fleshing out the alternative approach. This initially means determining what saving can be achieved by means of the 3% renovation obligation laid down by the Directive. It is then necessary to explore the options for an alternative approach which enables at least the same savings to be achieved.

1.2 Approach

The approach comprises two components. Firstly we determine what saving has to be achieved as a result of Article 5 of the EED and then explore whether it is possible to achieve that saving by means of an alternative approach.

In order to determine what saving has to be achieved as a result of Article 5 of the EED, we carry out the following calculation:

Step 1: We first apply the renovation requirements under the EPBD to the reference buildings and, using EPA software, calculate what energy index is thus achieved.

[6] The Directive uses the term ‘useful floor area’, which ECN has translated into Dutch as ‘gebruiksoppervlakte’.

Step 2: We then make a selection of the national building stock not complying with this energy index. Of this, 3% has to be renovated each year, starting with the buildings with the lowest label, i.e. energy label G. On the basis of this selection from the national building stock, we establish the average energy index and the average energy consumption per square meter.

Step 3: Comparing the average energy index of the selection from the national building stock from step 2 with the energy index of the reference buildings after renovation from step 1 gives rise to a percentage saving rate. This saving rate is multiplied by the average energy consumption per square meter of the selection from the national building stock, giving the saving per square meter. Multiplying the saving per square meter by 3% of the surface and the number of years in the period 2014-2020 gives the required total saving under Article 5 of the EED.

ECN has received building stock data from the Government Buildings Agency and Ministry of Defence in order to carry out this calculation. From the Government Buildings Agency we received a file with the energy-label data of 454 buildings (version of 9 October 2012), with a combined useful floor area of 2.4 million m2. ECN received more than 200 EPA reports for 1 262 buildings from the Ministry of Defence. and entered the relevant data from these reports into a database.

However, these data do not give a complete overview of the national building stock that is covered by the Directive. It is estimated that a good three-quarters of the national building stock is included in this exploratory study, which is sufficient for analysis.

Structure of the report

The required saving under Article 5 of the EED is dealt with in Chapter 2. ECN has based the options for an alternative approach on plans and studies of the Government Buildings Agency itself. These are discussed in Chapter 3. Chapter 4 draws a number of conclusions.

2

3% renovation saving

2.1 Renovation requirements of the EPBD

Article 5 of the Energy Efficiency Directive contains an annual obligation to renovate 3% of the building stock of the central government. After renovation these buildings must meet the minimum energy performance requirements as laid down for the Member State in question pursuant to Article 4 of the Energy Performance of Buildings Directive (EPBD).

The minimum requirements in respect of renovation are as follows for the Netherlands:[7]

- Rc of the shell 3.5 and U window 1.65[8].
- Heating requirement system performance 0.65.
- Hot tap water requirement system performance 0.29.
- Cooling requirement system performance 0.75.
- Ventilation system requirements only where the ventilation capacity > 5 000 m^3/h; the requirement is the maximum specific fan power 2.5 W/dm^3/s.

The system performance requirement for heating means that a high-performance boiler must be adapted and that a high-temperature release system and pipe insulation are adequate. For tap water a gas boiler, combination tap or decentralised electrical boiler is sufficient. The system performance requirement for cooling can be achieved with an ordinary compression cooler. The ventilation system requirement means new AC or DC ventilators with no flow control or recirculation. No requirements are imposed with regard to lighting.

The Minister for the Interior has already announced to the Lower House in 2012 that, from 2015, the minimum requirement for new buildings will be increased to Rc 5 as regards the insulation value of the shell.[9] The minimum requirements for renovations are now the same as the minimum requirements for new buildings and could be further strengthened. In the following paragraphs, we explain what that means.

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[7] http://www.rijksoverheid.nl/documenten-en- publicaties/rapporten/2012/05/31/energetische-eisen-bij-verbouw-vervanging-en- verbetering-van-bestaande-bouw.html

[8] The report in footnote 3 gives a U value of 2.0, provided it is the same as the new-building requirement. In view of the fact that the U value for new windows, doors and comparable building components is increased to U=1.65 W/m by the projected amendment of the Building Decree as of January 2013, this value is stated here. See also:
https://zoek.officielebekendmakingen.nl/kst-32757-40.html

[9] http://www.rijksoverheid.nl/documenten-en- publicaties/kamerstukken/2012/06/08/kamerbrief-over-verhoging-u-waarde-en-rc-waarde- voor-nieuwe-gebouwen.html

2.2 Energy index after renovation

In order to determine what saving has to be achieved as a result of Article 5 of the EED, we apply the renovation requirements of the EPBD to reference buildings and calculate, using EPA software, what energy index is thereby achieved.

However, for non-residential construction there are no official reference buildings for existing construction as there are for residential buildings. We use sample buildings from the 2005 DGMR report on the strengthening of EPC requirements for non-residential construction[10]. These sample buildings are also used in the Dutch Energy Agency's energy saving guidelines for existing construction. Here we merely take over the geometry of the reference building. The insulation values of the construction and the energy performances of the installations are adapted to the level of the EPBD renovations requirements.

The renovation requirements say little about cooling, ventilation and lighting installations. The system requirements for ventilation and cooling can be met with standard installations. We opt for buildings with compression-type cooling, mechanical extraction and energy-efficient lighting (10 W/m^2) because this approximates to an average situation.

The renovation requirements then lead to the energy index in Table 1.

Table 1: Energy index after renovation

Building type	Energy index after renovation
Offices	EI=1.54 (label E)
Prison building	EI=1.57 (label E)
Barracks	EI=1.65 (label E)

The results are sensitive to the above-mentioned assumptions regarding cooling, ventilation and lighting. The assumptions made by ECN lead to a mid-range value, as can be seen for offices in Table 2.

[10] J. Berben, 2005: *Aanscherping EPC-eisen utiliteitsbouw.[Strengthening of the EPC requirements for non-residential construction] Haalbaarheidsstudie [Feasibility study]*, DGMR, 2005.

Table 2. Sensitivity of the energy index after renovation to assumptions concerning cooling, ventilation and lighting

Cooling	Ventilation	Lighting	EI after renovation
Yes	Balance without heat recovery	17 W/m^2	1.98 (label G)
Yes	Balance without heat recovery	10 W/m^2	1.76 (label G)
Yes	Mechanical extraction	17 W/m^2	1.75 (label F)
Yes	Mechanical extraction	10 W/m^2	1.54 (label E)
Yes	Mechanical extraction	10 W/m^2	1.47 (label E)
Yes	Natural	10 W/m^2	0.86 (label A)

If the insulation value requirement for the building shell was raised to Rc 5 in 2015, the energy index would be slightly lower (see Table 3). The differences are small, however. What is stated in the following paragraphs is therefore based on the energy index after renovation from Table 1.

Table 3. Energy index after renovation when Rc=5

Building type	Energy index after renovation
Offices	EI=1,50 (label E)
Prison building	EI=1,54 (label E)
Barracks	EI=1.61 (label E)

2.3 A selection from the national building stock

The 3% renovation obligation refers to buildings owned and used by central government with a usable floor area larger than 500 m2; as of July 2015 it also includes floor areas of more than 250 m2. ECN has received building stock data from the Government Buildings Agency and the Ministry of Defence.

From the Government Buildings Agency we received a file with the energy-label data of all buildings (version of 9 October 2012), For this study we are focussing on buildings actually owned by the Government Buildings Agency and not rented properties because the latter are not covered by the EED renovation obligation. Buildings being used by others agencies also fall outside the scope, which means that museums are not included. Monuments are also excluded by the Directive.

ECN received more than 200 EPA reports for 1 262 buildings from the Ministry of Defence

and entered the relevant data from these reports into a database.

A selection is then made from the data files of buildings with a useful floor area of more than 250m^2 which do not meet the requirements of Article 5 of the EED (in this study converted into the EI of the sample buildings). Nevertheless, these must be included in the 3% renovation requirement. In the Ministry of Defence data only offices and barracks are selected or buildings which are mainly used, i.e. to an extent of more than 50%, as offices or barracks. Other defence buildings are explicitly excluded in the EED.

Table 4 provides information on the selection from the national building stock. More than 2 million m2 of useful floor area are involved, and more than half relate to Ministry of Defence buildings. In addition to central government offices, the category 'National Building Agency offices' also covers courthouses and customs and police buildings.

In the Directive, the European Commission asks that renovations begin with the worst buildings. The largest share of the selection from the national building stock also consists of buildings with a G label (see Table 5).

Table 4: Selection from the national building stock not complying with the energy index requirements after renovation

	EI selection criterion	Stock m^2 ufa	Number of buildings	Average EI[11]
National Building Agency offices	EI > 1.54	516 563	77	2.03
National Building Agency prisons	EI > 1.57	275 094	58	2.14
MoD barracks	EI > 1.65	453 695	168	2.96
MoD offices	EI > 1.54	885 817	308	3.31
Total		2 131 169	611	

Table 5: Selection from the national building stock with G label

	EI selection criterion	Stock m^2 ufa	Number of buildings	Average EI
National Building Agency offices	G label	393 424	57	2.16
National Building Agency prisons	G label	222 639	38	2.26
MoD barracks	G label	446 720	167	2.97
MoD offices	G label	881 994	307	3.32
Total		1 944 778	569	

[11] The calculation of average EI in tables 4 and 5 is weighted according to useful floor area.

2.4 3% renovation saving

Article 5 of the Energy Efficiency Directive stipulates that, in the period 2014-2020, 3% of the national building stock must be renovated each year in order to meet the requirements of Article 4 of the EPBD. This applies to the stock which does not meet those requirements, as outlined in Table 4. An annual renovation of 3% of the building stock over 7 years results in a total of less than 21% of the building stock because the 3% is successively calculated over a smaller stock. A total of 19.2% of the building stock will therefore be renovated over the period 2014-2020. What this corresponds to in square meters of useful floor area is indicated in Table 6. The data contained in Table 6 are based on current stock data and do not take account of the expected contraction of the real estate portfolio in the coming years.

Table 6: Area to be renovated at 3% per year

	EI selection criterion	Stock m^2 ufa	3% renovation saving per year First year in 2014 m^2 ufa	Renovation in 2014-2020 m2 ufa
National Building Agency offices	EI > 1.54	516 563	15 497	99 189
National Building Agency prisons	EI > 1.57	275 094	8 253	52 823
MoD barracks	EI > 1.65	453 695	13 611	87 117
MoD offices	EI > 1.54	885 817	26 574	170 092
Total		2 131 169	63 935	409 221

The area to be renovated is smaller than the floor area of central government buildings with a G label. The calculation of the saving is therefore based on the assumption that only buildings with a G label are to be renovated. This is consistent with the aim of renovations beginning with the worst buildings. The saving to which this renovation gives rise is calculated by comparing the average EI of the national building stock with a G label with the EI after renovation. This comparison gives rise to a percentage saving rate which we can multiply by the average energy consumption of the national building stock with a G label. This gives rise to a saving per square meter being renovated (see Table 7).

The energy consumption data are based on data from the National Buildings Agency and Defence. For buildings coming under the National Buildings Agency, the theoretical standard energy consumption is based on the energy label. For Ministry of Defence buildings, use is made of the actual energy consumption data contained in EPA reports, whereby the share of other electricity consumption is deducted in order to determine the energy consumption linked to a building.

Table 7: Saving resulting from the renovation of buildings with a G label so that they comply with the minimum requirements of the EPBD

	Average EII of G labels	EI after renovation	Saving %	Average energy consumption MJ/m^2	Saving in MJ/m per year
National Building Agency offices	2.16	1.54	29 %	1407	404
National Building Agency prisons	2.26	1.57	31 %	1567	478
MoD barracks	2.97	1.65	44 %	1247	554
MoD offices	3.32	1.54	54 %	1156	620

The saving in megajoules per square meter shown in Table 7 is multiplied by the floor area to be renovated according to Table 6. The total saving as a result of an annual renovation of 3% of the national building stock in line with the minimum energy performance requirements of the EPBD is 209 TJ or 0.2 PJ (see Table 8).

Table 8: Saving resulting from the 3% renovation of national buildings so that they comply with the minimum requirements of the EPBD

	Saving MJ/m^2 per year	Renovation 2014-2020 m^2 ufa	Saving 2014-2020 TJ per year
National Building Agency offices	404	99 189	40
National Building Agency prisons	478	52 823	25
MoD barracks	554	87 117	48
MoD offices	620	170 092	105
Total		409 221	219

3

An alternative approach

The required saving to be achieved on the basis of an obligation to renovate 3% of the national building stock in accordance with Article 5 of the EED was calculated in Chapter 2 This Chapter explores the options for achieving the required saving by means of an alternative approach. In this respect, the real-estate portfolios of the Government Buildings Agency and the Ministry of Defence are dealt with separately, although this is not necessary when implementing the Directive.

3.1 Alternative approach for the Government Buildings Agency

ECN has based the options for an alternative approach on an analysis commissioned by the latter and carried out by DHV in 2011[12]. The Government Buildings Agency (Rgd) develops, purchases and leases office space and other buildings for the Dutch central government. It buys buildings itself or leases them from investors, manages the buildings and rents them out to ministries and other central government bodies. The GBA aims to provide an optimum service to government departments and agencies in facilitating the meeting of targets relating to energy savings. Central government has set itself the target of making energy savings of 2% per year on average, resulting in an overall saving of 25% in 2020 as compared to 2008 (Rgd Annual Report, 2010). Another important target is 100% sustainable procurement from 1 January 2010.

The DHV study examines the effect of various scenarios.

- The application of sustainable procurement targets. In the case of leasing and purchase, the requirement is that the building being offered should have at least a C energy label. If the energy label is D or lower, additional measures are needed in line with EPA customised advice, the aim being to increase the label by two steps to energy label C.
- A scenario whereby the total office stock contracts and buildings from the Agency's own office stock with a poor label are disposed of more quickly.
- A scenario involving the application of functional control, tuning and testing. This scenario corresponds to a project (the FCIB project) which the Rgd is implementing with the aim of optimising the tuning of energy installations. The expectation is that this optimisation might enable the energy consumption of individual buildings to be reduced by 15%. The scenario involves an assessment of the potential energy savings at overall

[12] DHV, 2011: '*Rijksgebouwendienst portefeuilleanalyse energetische kwaliteit 2011 Kantoren en penitentiaire inrichtingen*' *[2011 Energy quality review of the Government Buildings Agency portfolio - Offices and prisons]*, December 2011.

stock level.

- A scenario involving the use of main contracting and/or energy service companies (ESCOs). This scenario gives an impression of potential energy savings as a result of the use of performance contracts involving the management of energy installations being transferred during the term of the performance contract and the contractor guaranteeing a certain energy saving.

The potential savings indicated in the DHV study are summarised in Table 13. Here we are considering only owned offices and prisons because only these are directly relevant to our study. However, an alternative approach might also include rented buildings. The application of sustainable procurement criteria in line with the DHV scenario reduces the average energy label of offices and prisons to C. The disposal of buildings with low energy performance in combination with the sustainable procurement criteria leads to the complete elimination of E, F and G labels from the Rgd's office stock. In the last scenario, the average label increases to A.

Table 13: Potential savings from scenarios in the DHV study for the Rgd

Scenarios	Owned offices Potential savings TJ per year	Prisons Potential savings TJ per year
Application of sustainable procurement criteria	284	197
Sustainable procurement plus disposal of buildings	949	N.A.
Application of the FCIB project	165	141
Sustainable procurement plus use of ESCOs and main contracting	769	593

The potential energy savings outlined in the DHV study are three times greater than the required savings for offices and prisons coming under the Government Buildings Agency in the case of a 3% renovation per year in line with the minimum requirements of the EPBD.

Moreover, the number of buildings with an F or G label is reduced as a result of the application of sustainable procurement criteria. The contraction of the building stock can also contribute if it is achieved by disposing of buildings with poor labels. The DHV study assumes that 40% of the owned office floor area will be disposed of by 2020. This will also reduce the savings target for Article 5 of the EED. The central government building stock is becoming smaller and of better quality.

If the buildings of the Government Buildings Agency were renovated to meet the minimum energy performance requirements of the EPBD, this would mean an energy saving of 30% for each building (see Table 7). With a renovation rate of 3% per year, this means a 1% energy saving per year for the entire portfolio. In the context of the Directive, this means much less than a 1% energy saving per year because it is not necessary to renovate 3% of the entire

portfolio but only 3% of that portion which does not meet the minimum energy performance requirements of the EPBD[13]. With a 2% energy saving per year, in line with government policy, the Government Buildings Agency amply meets this. The total gas and electricity consumption of all buildings of the Government Buildings Agency is more than 5 000 TJ[14]. Over the period 2014-2020, the objective of a 2% energy saving per year means an overall energy saving of 14%, or 700 TJ.

3.2 Alternative approach for the Ministry of Defence

EPA approach of the Ministry of Defence

ECN has based the options for an alternative approach on an analysis conducted by the Defence Buildings Agency from March 2011[15]. The Defence Buildings Agency has been implementing the Energy Performance Advice project for a number of years. Energy performance advice has now been developed for all heated Ministry of Defence buildings built before 1999 and with a net floor area larger than 1 000 m2. 851[16] buildings have been examined with a total floor area of 2.9 million m2 gfa. The EPAs were drawn up in the period 2004-2009. The implementation of the recommended energy saving measures resulting from this EPA approach involves a EUR 65 million investment in the period 2009 to 2019. These investments lead to savings of 600 TJ, while the average payback period of the package of measures is 7 years. A selection of the recommended measures has been made. Measures with a simple payback period which is longer than the life of the building element in question are not implemented. In the period 2009 up to and including 2011 more than EUR 10 million has been spend on recommended EPA measures. These are giving rise to an energy saving of 77 TJ. However, this figure is for all building types combined, i.e. not just offices and barracks but also workshops, warehouses, storage facilities and canteens.

Selection of offices and barracks

Ministry of Defence buildings receiving EPA totalling 2.7 million m2 in useful floor area (2.9 million m2 gfa) have been examined. All types of buildings are covered, however. The selection of the offices and barracks that do not meet the EPBD energy performance requirements is slightly less than half of the total. The potential energy savings for this selection, based on the EPA approach, is therefore estimated to be approximately 300 TJ. The potential energy saving is twice the savings target for Ministry of Defence offices and

[13] Of all of the Government Buildings Agency's buildings with an energy label (2.4 million m2 in total useful floor area), 33% (approx. 800 000 m2; see Table 4) do not comply with the energy performance requirements of the EPBD.

[14] http://overheid.nl/media/downloads/JaarrapportageBedrijfsvoeringRijk2012.pdf

[15] EPA Report 2012, '*Voortgang en effect energiebesparende maatregelen periode 2009 tot en met 2011'[Progress and effect of energy saving measures in the period 2009-2011]*, Defence Buildings Agency, version of 21 March 2012

[16] ECN has identified more buildings (a total of 1 262) in the Ministry of Defence's EPA reports, but these are data from the end of 2012 while the 2012 EPA Report presents the situation at the beginning of 2012.

barracks in the case of a 3% renovation per year in line with the minimum requirements of the EPBD. Further roll-out of the EPA approach will enable the target of Article 5 of the EED to be achieved provided sufficient resources are allocated in the period 2014-2020.

Demolition and disposal

The floor area of offices and barracks subject to the renovation requirement might still fall as a result of demolition and disposal. The building stock data used in Chapter 2 have not been corrected to take this into account. Replacement new buildings also count towards compliance with the renovation requirement.

Figures from the Multi-annual Disposal Plan indicate that the Ministry of Defence is expected to dispose of offices totalling 250 000 m2 in gross floor area over the period 2012-2018. This corresponds to approximately 237 500 m2 in useful floor area. Only part of that volume overlaps with the buildings in the selection in Chapter 2. It is likely that no energy performance advice has been given for a number of buildings because the Ministry of Defence intends to dispose of the building concerned. It is not possible to say what portion of the buildings in the Multi-annual Disposal Plan overlaps with the building stock selection in Chapter 2 because the disposal figures indicate object codes but no building numbers. It is also unclear from which year the buildings will not longer count towards the EU requirement: from when they become surplus to requirements, from when they are vacated or from when they are actually disposed of. In view of the fact that Article 5 of the EED concerns buildings that are owned and used by central government, it can be assumed that the year in which a building is vacated is decisive.

Figures concerning the demolition of Ministry of Defence buildings indicate that offices and barracks with a total gross floor area of 78 000 m^2 are designated as ‘being demolished’, while 270 000 m2 are designated as ‘suitable for demolition’. Of the buildings with the designation ‘being demolished’, a floor area of 41 000 m2 overlaps with the selection from the building stock with label G in Chapter 2. It is unclear when these buildings will be demolished.

It can cautiously be concluded that demolition and disposal might reduce the savings target of the 3% renovation requirement by around 10% compared to the calculations set out in Chapter 2.

Buildings larger that 250 m2

The EPA approach is currently targeted at buildings with a net floor space of more than 1 000 m2. Article 5 of the EED is aimed at buildings with a useful floor space of more than 500 m2 (250 m2 from July 2015). At the end of 2012, the Ministry of Defence prepared an inventory for ECN and came up with a figure of 1.8 million m2 in useful floor area (1.9 million m2 gfa) for office buildings and barracks larger than 250 m2 that were not being disposed of and were still in use. We found 1.7[17] million m2 in the EPA reports. This means that the saving as a result of the renovation requirement indicated in Chapter 2 was calculated on the basis of more than 90% of the floor area of all buildings larger than 250 m2. If all of these smaller buildings were also inventoried and included, the required saving as a result of the requirement to renovate 3% of the national building stock under Article 5 of the EED would therefore be only slightly higher than calculated in Chapter 2. The potential savings from the EPA approach for all buildings larger than 1 000 m^2 is thus still more than enough to achieve the required saving.

[17] This covers 1.3 million m2 in Ministry of Defence offices and barracks, as reported in Table 4, plus 0.1 million m2 in offices and barracks which meet the minimum energy performance requirements of the EPBD, plus 0.3 million m2 in offices and barracks in buildings more than 50% of which is used for other functions.

4

Conclusions

What saving is achieved by the 3% renovation obligation?
In this report, ECN has calculated the required saving resulting from the requirement under Article 5 of the Energy Efficiency Directive (EED) to renovate 3% of the central government building stock each year. After renovation the buildings must meet the minimum energy performance requirements as laid down in Article 4 of the Energy Performance of Buildings Directive (EPBD) by the Member State. Of the national building stock, 2.1 million m2 in useful floor area do not at present meet the requirements established by the Netherlands in the EPBD context. An annual 3% renovation of the building stock to the level of the EPBD requirements means that a total of more than 400 000 m2 must be renovated in the period 2014-2020. The realised energy saving amounts to 219 TJ (0.2 PJ), assuming that buildings with an energy label G are renovated first.

ECN has performed this calculation on the basis of data from the Government Buildings Agency and the Ministry of Defence concerning the current building stock. These data do not yet give a complete overview of the national building stock that is covered by the Directive, but more than 90% is estimated to be included. The final savings target might therefore be slightly higher. The calculation does not take account either of the demolition and disposal of buildings. It can cautiously be concluded that demolition and disposal might reduce the savings target of the 3% renovation requirement by around 10%.

Is an alternative approach possible?
The EED allows an alternative approach to be used in order to achieve the same energy savings. On the basis of the analyses in this report, it can be concluded that it is certainly possible to comply with Article 5 of the EED Directive on the basis of an alternative approach.

- If the buildings of the Government Buildings Agency were renovated to meet the minimum energy performance requirements of the EPBD, this would mean an energy saving of 30% for each building (see Table 7). With a renovation rate of 3% per year, this means a 1% energy saving per year for the entire portfolio. In the context of the Directive, this means much less than a 1% energy saving per year because it is not necessary to renovate 3% of the entire portfolio but only 3% of that portion which does not meet the minimum energy performance requirements of the EPBD[18]. With a 2% energy saving per

[18] Of all of the Government Buildings Agency's buildings with an energy label (2.4 million m2 in total useful floor area), 33% (approx. 800 000 m2) do not comply with the energy performance requirements of the EPBD.

year, in line with government policy, the Government Buildings Agency amply meets this. The total gas and electricity consumption of all buildings of the Government Buildings Agency is more than 5 000 TJ[19]. Over the period 2014-2020, the objective of a 2% energy saving per year means an overall energy saving of 14%, or 700 TJ.

- The Government Buildings Agency can achieve the 2% energy saving per year through sustainable procurement, optimising and tuning of energy installations or the deployment of ESCOs and energy performance contracting.
- The Defence Buildings Agency has been implementing the Energy Performance Advice project for a number of years. Energy performance advice has now been developed for all heated Ministry of Defence buildings built before 1999 and with a net floor area larger than 1 000 m2. The implementation of the recommended energy saving measures from this EPA approach involves a EUR 65 million investment in the period 2009 to 2019. These investments lead to savings of 600 TJ, while the average payback period of the package of measures is 7 years. This potential concerns all types of buildings. The selection of the offices and barracks that do not meet the EPBD energy performance requirements is slightly less than half of the total. The potential energy savings for this selection, based on the EPA approach, is therefore estimated to be approximately 300 TJ. The potential energy saving is twice the savings target for Ministry of Defence offices and barracks in the case of a 3% renovation per year in line with the minimum requirements of the EPBD. Further roll-out of the EPA approach will enable the target of Article 5 of the EED to be achieved provided sufficient resources are allocated in the period 2014-2020.
- In this respect, the real-estate portfolios of the Government Building Agency and the Ministry of Defence are dealt with separately, although this is not necessary when implementing the Directive. It is thus still possible to seek optimisation and make choices between these two real estate portfolios.

[19] http://overheid.nl/media/downloads/JaarrapportageBedrijfsvoeringRijk2012.pdf

ECN

Westerduinweg 3 PO Box 4

1755 LE Petten 1755 ZG Petten

Tel.: 088 515 4949

Fax: 088 515 8338

info@ecn.nl

www.ecn.nl