Study commissioned by the Federal Public Service of Public Health, Food Chain Safety and Environment on behalf of the National Climate Commission

Specification no. DG/KV/DP/08001

Reduction of emissions resulting from policies and measures taken by the Federal Government for the period 2008-2012

Final Report

3 July 2009

CONTENTS

1 INTRODUCTION

The legal basis for the obligation to evaluate the federal policies and measures (PAMs) is the cooperation agreement of 14/11/2002 between the Federal State, The Flemish Region, the Walloon Region and the Brussels Capital Region, in which it is stated that a National Climate Plan will be drawn up, executed, evaluated and reported to the UNFCCC under the Kyoto protocol.

In article 13 is stated that the Federal State and each Region commit themselves to report annually in a harmonized way to the National Climate Commission (NCC), on the progress and implementation of PAMs that are included in the National Climate Plan and that fall under their authority.

Through the "Burden sharing agreement" of 8 March 2004 between the Federal Government and the Regions, the Federal Government has committed itself to take a series of complementary emission reduction measures for at least 4,8 million tonnes CO_2 per year over the period 2008-2012.

This project will help the Federal government with the evaluation of the federal PAMs by meeting the following objectives:

1. A table with, for each federal PAM, avoided CO_2-eq emissions for each year in the 5 year period 2008-2012, with a minimum and a maximum scenario.
2. A description, for each PAM, of the hypotheses in the calculation of the avoided emissions.

The federal measures in the National Climate Plan have been screened. In total, 42 federal policy measures[1] have been identified.

During a first meeting of the steering group, on the 9th of January 2009, the committee went through the list of federal PAMs in the National Climate Plan that had to be evaluated and identified the relevant contact persons for obtaining information on these measures.

A second meeting of the steering group was organized on the 24th of March 2009, during which the committee discussed the interim report, with the set of main assumptions and data to be used in the calculation of avoided CO_2 emissions. Remarks were noted for each PAM and taken into account for the following tasks.

During an interim meeting on the 15th of May 2009, preliminary calculations of the most relevant PAMs were discussed in more detail with representatives of FPS Environment.

[1] In this report we will be using indifferently the terms "measure", policy measure" or "PAM" (from "policies and measures").

The content of the present report is the following:

- Chapter 2 describes the data collection. The overlap between federal measures and regional measures is given in an overview, per sector and/or technology.
- Chapter 3 contains an overview of the methodology and the difficulties encountered.
- In chapter 4, general assumptions and an overview of assumption per PAM or cluster of PAMs are given.
- In chapter 0, the calculation methods used in the Excel files are described per PAM. More information on the choice of assumptions is provided and results are presented. In the final section, a summary of the results is also given.
- In Annex 1, the relevant links between this study and the study performed by the consortium on the development of an indicator database for the National Climate Plan are given.
- Annex 2 gives a list of the Excel files with the calculations per measure.

It should be stressed, as is explained later in more detail, that the evaluation of avoided future emissions is an ambitious task, especially given the number of PAMs, the lack of existing studies, the limited availability of statistical data, the overlap with regional measures, etc.

Therefore, this study should be considered as a first step. It has followed a pragmatic and simplified approach, based on a number of transparent hypotheses. Despite the lack of data, it has attempted to provide at least an order of magnitude of the impact of the most important measures.

Terminology

Three concepts of "measure" can be distinguished:

- *national measure*;
- *federal measure*;
- *regional measure*.

Each measure of the National Climate Plan, which is identified by a code such as EP-A02 or EC-B03, is actually a mix of one or more federal and/or regional measure(s). We call this mix a *national measure*. In this study, we are only interested in the national measures comprising a federal measure. Such a national measure is composed of either one federal measure or one federal measure and one or more regional measure(s).

In this report we will refer to federal measures by the code of the corresponding national measure.

When regional measures are associated with a federal measure in a same national measure, these measures are said to be *linked*.

2 DATA COLLECTION

The description of measures in the National Climate Plan is often rather general. In a first step, the work has consisted in getting a more precise description of each federal measure (i.e. the federal part of each national measure), in particular through the related legal references. Questions that have been addressed include :

- What has been decided?
- Since when is it applicable? (this is important for measures promoting energy saving investments, which have a cumulative effect in time)
- For which period has the measure been decided? (e.g. up to next year or up to 2012?)
- What modifications have taken place since?

Secondly, data has been collected on the implementation of most PAMs, such as:

- budgets allocated;
- number of equipments or investments supported;
- number of EMAS certified public services, number of civil servants concerned;
- size of fuel excises;
- emission factors;
- …

It is important for each federal measure to know whether or not it is linked to 1 or more regional measures. This can influence the CO_2-reduction to be allocated to the federal measure. For example the fiscal deduction for an investment in renewable energy at federal level overlaps with subsidies given at the regional level.

Table 1 shows the relationships between the federal PAMs and the emission reduction technologies per sector and, therefore, also the relationships between federal PAMs. This allows to notice where overlapping between different PAMs can occur. The first column indicates where regional measures are included in the corresponding national measure, while the first row shows which technologies are being supported by regional measures.

		Energy sector					Residential									Transport						Agri			Industry					federal public services									
PAM	regional PAM	offshore wind energy	wind	biomass	gas	new fosil power plants	Electrical appliances	inefficient and polluting heaters	condensing boilers	PV panels	Roof insulation	Heath pump	Thermostatic valves radiators	Solar water heaters	other	Mobility of cars	Public transport use	Bicycle use	Transport of goods	Efficiency of cars	biofuels	forests	solid biofuels	waste - ecotoax	Energy efficiency measures	CHP	condensing boilers	EE saving investments	fluorinated gases	low emission equipement	other	RUE pubic buildings	third investor (FEDESCO)	Mobility	Modal shift in transport	bicycle use	tele-working	efficiency cars	awareness
regional PAM			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									
EP-A02	X		X	X	X																																	
EP-A03	X		X	X	X																																	
EP-A05	X	X																																				
EP-B01	X					X																																
EC-A05	X						X																															
EC-B04							X																															
EC-B01	X								X	X	X	X	X	X																								
EC-B02	X							X																														
EC-B03	X								X	X	X	X	X	X	X																							
EC-C01																																	X					
TR-A01	X															X																						
TR-A02	X																X																					
TR-A03	X															X		X																				
TR-A04	X																		X																			
TR-A08																	X																					
TR-B01	X															X																						
TR-B03	X															X																						
TR-B05	X																			X																		
TR-C01	X																			X																		
TR-C02	X																			X																		
TR-D01																					X																	
AG-C02	X																					X																
AG-D04																							X															
AG-E01	X																						X															
WA-A01	X																							X														
IP-A06	X																								X	X	X	X										
IP-B01	X																												X									
SE-A01	X																																					X
SE-A02	X						X		X	X	X	X	X	X	X					X																		
SE-A03	X																																					X
SE-A07	X																																					X
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OB-C02																X	X																		X			
OB-C03																X		X																		X		
OB-C04																X																					X	
OB-C07																				X																		X

Table 1. Matrix Table with for each federal PAM an overview of the technologies and sectors targeted.

3 METHODOLOGY

The impact of a policy measure in terms of emission reduction is defined as the difference between the actual emissions and the emissions that would have taken place had the measure not been implemented (generally called "baseline"), as is illustrated in Figure 1.

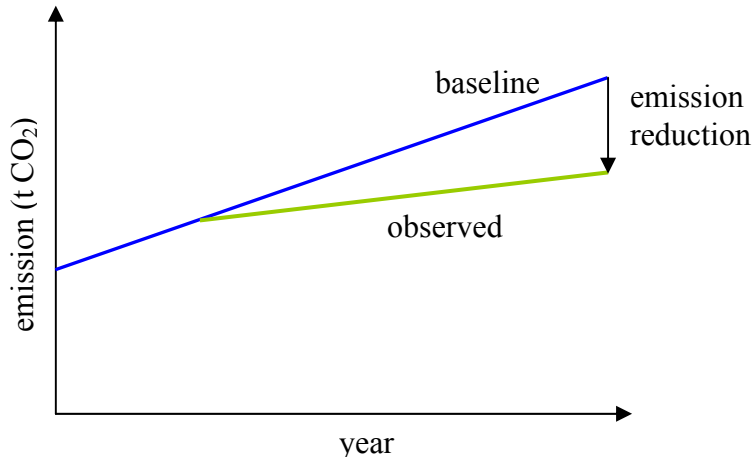


Figure 1. Emission reductions are based on observed and baseline emissions but can often be assessed directly.

A difficulty in evaluating this emission reduction arises from the fact that in general the baseline can not be measured precisely, but can only be estimated on the basis of assumptions. Note that this type of uncertainty is also true for the impact of economic policies on employment or GDP. In this study, we therefore have adopted methodologies to determine the difference between actual and baseline emissions directly.

The Federal government has taken many policies and measures that have a positive effect on greenhouse gas emission reductions. These differ substantially from one another in several characteristics, but there are some general characteristics that need to be considered in calculating the effect on emission reductions.

Difficulties hampering the evaluation are listed in the next section. The way we addressed these difficulties will be presented in the subsequent sections.

3.1 Difficulties encountered

Evaluating the impact of policy measures is an ambitious task, as can be noticed from the following difficulties, which had to be addressed and could require particular assumptions.

Cumulative vs. non-cumulative measures

Cumulative PAMs often include investments in renewable energy (e.g. offshore wind energy) and investments increasing energy efficiency (e.g. in buildings, cars, …). The effect of these investments on the emission reduction will last the entire life expectancy and is not limited to the year of investment. Non-cumulative PAMs on the other hand include mostly changes in behaviour induced or not by a financial incentive. An example is lower prices for promoting an increased use of public transport. These emission reductions only take place at that specific moment.

Overlapping measures

The evaluation of the impact of an individual measure must take into account that other measures can contribute to a same effect. This can be the case of other federal measures or regional measures. These other measures are modifying the baseline.

An example of a set of overlapping measures is the following:

- TR-A03: Promotion of bicycle use
    - fiscal deduction of the allowance paid by employers
    - lump sum fiscal deduction of the expenses for home-work transport other than with a car
- OB-C03: Promotion of bicycle use in the public sector
    - fee per km awarded to civil servants going to work by bike
- TRA-02: Improvement and promotion of public transport
    - includes objectives for bicycle parking places in the management contract of the SNCB group of companies.

A second example is the following :

- EC-B01: fiscal reduction for energy saving investments by citizens (condensing boilers, heat pumps, roof insulation, solar panels…);
- regional subsidies for energy saving investments (for similar types of equipments).

There are potentially 2 types of overlaps (Figure 2). In the first, the emission reductions of a certain PAM are completely incorporated within the emission reductions from another PAM. In the second, only a portion of the total emission reductions of two different PAMs are overlapping.

Complexity of some of the measures

Certain financial incentives change in time (rate or ceiling of the subsidy, technologies supported…), while there is often a cumulative effect in time.

There are also combined incentives (e.g., fiscal reduction linked to the presence of a particle filter).

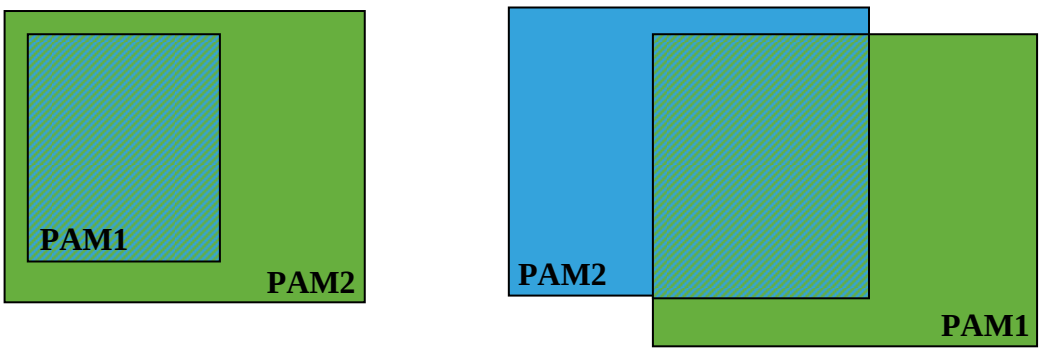


Figure 2. Illustration of two types of overlap of PAMs

Limitation in data availability

There is often a lack in statistical data for an appropriate monitoring of the measure. Examples are:

- Measure EC-B01 (fiscal reduction for energy saving investments): the data on number of reductions and corresponding amounts of money are only available for the period up to 2006 and are not divided by technology.
- Measure TR-A03 (fiscal deduction for use of a transport means other than individual car): no data by type of transport (bicycle or car pooling) is available.

Measures with indirect impact

Examples of measures with indirect impact, of which the evaluation is not obvious, are:

- information and awareness raising campaigns;
- making available diagnostic tools;
- mobility plans;
- fuel certifications.

Other factors requiring hypotheses

There are several other factors, not directly related to the PAM, but that require additional hypotheses. These are:

- the free-rider effect. Examples of measures for which this effect exists are:
    - the free ticket given to civil servants travelling to work by train;
    - the fiscal reduction for clean cars;
- the multiplier effect (people making energy saving investments because their neighbours did, however without applying for financial support…);

- the rebound effect (increase in useful energy consumption resulting from the fact that energy savings have made useful energy cheaper);
- the impact of energy prices on the penetration of energy saving technologies or the use of cars.

3.2 General approach

The quality of the evaluations is a function of the available statistical data related to the implementation of the policy measures, as well as of the available time and manpower resources available for carrying out the analysis.

Given the number of policy measures to be considered, a detailed evaluation for each was beyond the scope of the present study. As far as possible, we tried to use existing studies on the evaluation of particular measures. However, in practice such evaluations are hardly available. Therefore, we have in general made our own assessments, sometimes using necessarily simplified and, hence, approximate approaches.

The evaluation will be focused on those measures expected to be the most significant in terms of emission reduction or cost. It should indeed be noted that since the impact of the measures can be very different from one PAM to another, the knowledge of an order of magnitude of the impact of the less significant ones can already be quite useful.

Given the uncertainties on a number of parameters and the hypotheses needed, the analysis has been carried out in a transparent way, with all data sources and assumptions being made explicit, so as to allow changes in parameters if better information becomes available in the future and sensitivity analyses to be carried out. The analysis should not be considered as a final one, but rather as a first step, which should be improved in the future.

More specific points are addressed in the following sections.

3.3 Overlapping measures

Wherever two or more measures overlap, the calculation has been adapted in such a way as to eliminate any double counting of emission reduction impacts. This has been done by:

- taking into account the common impact under one of the overlapping measures;
- setting to zero the impact of the measures of which the impact is included under another measure.

3.4 Clustering of measures

In some cases, the impact can be estimated more precisely for two or more measures together than for each of these measures individually.

This is the case of the federal measures stimulating the development of offshore wind energy (measures EP-A01 and EP-A05), where the impact is best estimated from the

installed capacity expected for the years 2008-2012, based on actual projects. In this case the impact has been estimated for both measures combined. This is also the case of fiscal measures supporting investments for which there are regional subsidies. In such cases the impact is evaluated for the different measures together. Where there is a contribution of regional measures, the emission reduction is allocated between federal and regional PAMs, which is explained in section 3.5.

3.5 Allocation of impact between federal and regional PAMs

As far as possible the allocation of an impact between federal and regional measures has been based on quantitative data. The relative impacts have been assumed to be proportional to the size of the financial support of the federal and regional measures[2].

Two cases are considered:

- In the case of financial incentives such as fiscal deduction, fiscal reduction and subsidies, the emission reductions have been allocated proportionately to the relative amounts of money (amount of fiscal reduction, subsidies) spent for the corresponding measure by the respective federalised entities. For example, if the federal measure constitutes a tax reduction of 40 € and the regional measure a premium of 10 €, 80 % of the emission reduction will be allocated to the federal PAM and 20 % to the regional PAM.
- In the case of fuel taxes for electricity production and the green certificates scheme, the impact has been allocated proportionately to the relative size of the impact of these measures on the cost of electricity production.

3.6 Impact of energy prices

To what extent did the high energy prices of recent years influence the impact of the federal PAMs?

These high prices have to a certain extent prompted households, public services and companies to reduce their energy consumptions, to buy cleaner vehicles than they would have done otherwise, to make more energy saving investments. But they also had an impact on the baseline emissions for each PAM (the emissions that would have taken place in the absence of the PAM).

To quantify such effects is very tricky (because the number of parameters involved, the anticipation of future price evolutions and the dynamic nature of the process) and falls beyond the scope of this study.

We have followed a simplified approach by neglecting the net effect of the energy prices on the impact of the PAMs.

[2] Although we have to underline that in some cases, the lowest financial incentive might presumably not have been sufficient to induce a significant effect without the high financial incentive.

3.7 Free rider effect

A correction for the free rider effect should in principle be made when the impact on emissions is estimated on the basis of a number of tax reductions or subsidies awarded, if a significant number of recipients of the financial support are likely to have made the emission reduction without this support.

In the framework of the EMEEES project, which developed bottom-up methodologies for evaluating energy savings in the framework of European directive 2006/32/EC, it has been suggested that free rider and multiplier effect might compensate each other, especially if the PAM is relatively small.

This assumption seems too rough to be applicable for all federal measures of the National Climate Plan. The impact of the free rider effect has been taken into account implicitly or explicitly for the main measures for which the available data allowed it.

3.8 Multiplier effect

The multiplier effect is the fact that e.g. people have been led to invest in energy saving or renewable energy because they heard of financial incentives, but without actually applying for these incentives.

This effect could only be taken into account when the impact of a measure is based on the total actual penetration of a technology, for example the promotion of railway for passenger transport.

3.9 Uncertainty

There is a great deal of variation in the impact of the federal PAMs. Some measures, such as the promotion of offshore wind energy have a substantial effect on CO_2 emissions, whereas others only have a very marginal one, for instance sustainable criteria for food in some federal restaurants. Upper and lower bounds are provided for the most important measures in terms of emission reduction.

For measure EC-B01, which has the largest estimated impact on emissions, and for which the calculation of emission reduction is the most complex, while there was a lack of appropriate statistical data, we have carried out a detailed uncertainty analysis using the Crystal Ball software, based on a Monte-Carlo simulation method. The ranges obtained are assumed to correspond to 95% confidence intervals.

For the remaining measures, the upper and lower bounds are based on specific circumstances related to particular technologies (offshore wind, biofuels) as well as on an admittedly subjective ‘expert judgement’ of the consultants.

4 MAIN ASSUMPTIONS BY MEASURE

4.1 General assumptions

It is assumed that, when they have no time limitation, the fiscal measures will be maintained at their current level and for the same types of purchases or investments up to the end of 2012.

Given the uncertainty on the impact of some measures such as information campaigns[3] a general approach has consisted in giving preference to conservative assumptions, tending to underestimate, rather than to overestimate, the impact of such measures. This has led us in particular to assume a zero impact for a number of marginal measures of which the impact, although very uncertain, can however be considered to be comparatively minor.

The National Climate Plan, an inventory of all existing policy measures, does not always clearly specify the departure date of the measures. We have assumed that the departure date of the federal measures to be evaluated in this study is not earlier than 2004, year of the burden sharing agreement between the federal government and the Regions.

4.2 Starting date of the PAMs

The National Climate Plan being an inventory of existing measures, the starting date of the PAMs can date back more or less in time.

As this study's objective is among other things to monitor the progress towards achieving the commitment made in the burden sharing agreement of March 2004, the federal PAMs to be evaluated did not start earlier than 2004.

4.3 Emission factors for electricity savings

4.3.1 Electricity

One parameter that can considerably influence the estimated emission reduction is the assumption on the emission factor for electricity savings, i.e. the average emission per kWh of the electricity that would have had to be produced if the measure had not been implemented.

If the conventional electricity production can be reduced as a result of either direct electricity savings or the production of electricity from renewable energy sources, the

[3] Note, however, that the impact of information campaigns is implicitly taken into account when the impact of the measure is estimated on the basis of the actual penetration of a particular technology.

overall emissions are reduced proportionately to the emission factor of the power plants that reduce their production (it is assumed that electricity imports remain unaffected).

Assumptions made for this emission factor in the literature can vary significantly, for example between:

- the average emission factor of electricity production in the country (which in Belgium is relatively low, because of the nuclear electricity generation);
- the average emission factor of electricity production from fossil fuels;
- the emission factor of a marginal plant (e.g. that of a natural gas combined cycle power plant or of a coal power plant).

In this study, we have assumed that the electricity that would not have to be produced is that of a combined cycle gas turbine power plant (CCGT) burning natural gas with a net efficiency of 53% (average the plants of Vilvoorde and Ghent). Taking into account 4,5% electricity transport & distribution losses, the corresponding emission factor is 397 g CO_2/kWh.

Actually, the marginal power station could also at times be a coal power plant or a conventional gas power plant, which have higher specific emissions. Therefore the hypothesis of a CCGT plant can be considered as a conservative value, chosen because of the uncertainty on the actual marginal plant, which will in particular depend on the future relative fuel prices.

4.3.2 Fuels

The CO_2 emission factors for natural gas and heating oil were taken from the 1996 IPCC guidelines [1].

natural gas	55,8 kg/GJ
heating oil	73,3 kg/GJ

4.3.3 Cars

In this report two CO_2 emission factors for cars are used: one for the car stock (which is the average emission factor of all cars on the road in a given year) and one for the average new car.

	Emission factor cars (g CO_2/km)	
	Car stock	**New cars**
2008	164,6	143,5
2009	163,3	140,8
2010	162,0	138,1
2011	159,8	135,4
2012	157,6	132,7

4.4 Baseline

An important assumption is the baseline to which an equipment is compared, especially when it concerns the replacement of existing equipment (case of a condensing boiler or double glazing). In the discussions on the monitoring of the Energy Efficiency Services Directive [2] that are still going on at the moment, some alternatives were considered:

- comparison of the new equipment with the one it replaces. In this case, the saving calculated is an overall effect, i.e. not only the saving induced by the PAM but also that arising from the fact that old equipment is being replaced by new;
- comparison of the new equipment with the equipment that would have been purchased in absence of the PAM. In this case, only the effect of the PAM is considered.

In this study, the overall effect has been estimated, the new equipment being compared to the one it replaces. In this study, for the period concerned, we have also assumed a constant baseline for each technology.

4.5 Number of degree-days

The number of heating degree-days used is 2415 [3].

4.6 Assumptions by measure

Table 2 lists all federal PAMs, giving for each:

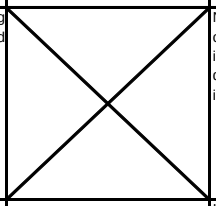
- a brief description of the national measure;
- a brief description of the federal part of the national measure;
- the kind of impact on GHG emissions that has been estimated;
- the main assumptions made, in particular concerning the baseline.

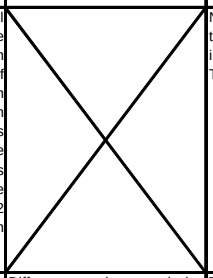
The remarks made during the 2nd steering committee have been taken into account. For more detail on the assumptions used and the reasoning, we refer to the description of each Excel template in section 5.2.

Table 2. List of PAMs with measured impact on emission reductions and the most important assumptions.

No.	Name of national measure		Description of national measure	Description of federal part of the national measure	Estimated impact on emissions	Assumptions
1	**EP-A01**	Green certificates	With a view to ensuring the placing on the market of a minimum volume of green electricity, a system GCs and CHP certificates was established, both at the regional and federal levels. Electricity suppliers are obliged to provide a minimum amount of electricity sold form renewable energy sources. A minimum price has been fixed for GCs.	Green certificates system at the federal level: minimum price guarantee	Total impact of offshore wind on CO2 emissions. Lower emissions from electricity production, through replacement of fossil electricity production by offshore wind electricity.	Offshore wind energy replaces electricity from natural gas in CCGT plants. Its penetration will be that of the already planned or approved projects for 2012. Linear interpolation 2008-2012.
2	**EP-A02**	Financial support for electricity generation from RES	In addition to the Green Certificates scheme, the Belgian authorities have implemented several measures to promote generation from RES. RES and CHP producers enjoy priority access to the grid in all regions. The Federal Government has also taken a number of additional measures which reduce the relative cost of electricity from RES. The regions offer ecology premiums that can be cumulated with the federal measures.	Special excise tax on fossil fuel for electricity production : 15€/t for heavy oil and 8,65€/t for coal. 'Cotisation sur l'énergie/Bijdrage op energie' of 3€/t of coal.	Impact from the replacement of coal by natural gas for electricity production which is induced by the coal price increase	Small impact on the production of electricity from biomass, evaluated proportionally to the size of the excise tax in comparison with that of the green certificate system of the Regions. No impact on electricity imports.
3	**EP-A03**	Stopping the exemption from excise & establishment of an excise duty on energy for coal and heavy fuel oil products	The federal government ended the system of excise duty exemptions for coal, coke, lignite and heavy fuel oil, which were previously exempt from excise duty for electricity. It has been decided in parallel to establish an excise duty (8.65 € / kg in 1000) on coal, coke and lignite to deter their use coal as raw materials for the production of electricity. One consequence of that is a shift from coal power to biomass energy production.	Included under EP-A02	Included under EP-A02	
4	**EP-A05**	Action Plan for renewable energy and CHP: offshore wind	The federal Council of Ministers set a target of 2000 MW for electricity from offshore wind. An assessed contribution of the grid operator is introduced (financing for network expansion, purchase of certificates). Federal government guarantees project investment in case of interruption by authorities. Regions establish administrative regulations for the implementation of on-shore wind turbines.	The federal Council of Ministers set a target of 2000 MW for electricity from offshore wind. An assessed contribution of the grid operator is introduced (financing for network expansion, purchase of certificates). Federal government guarantees project investment in case of interruption by authorities. Simplification of procedures.	Lower emissions due to replacement of fossil energy by wind energy for electricity production. Included under EP A01	
5	**EP-B01**	specific improvement for allocation of emission quotas to power producers	The Belgian allocation plan is the compilation of 3 regional allocation plans. Prior authorization is required for any new installation who develop more than 25MW (also for expanding plants). The criteria are based on: needs, network integration, use of BAT, choice of fuel,... The methods of calculating amounts of allowances vary by region.	Prior authorization is required for any new installation that develops more than 25MW (also for expanding plants). The criteria are based on: needs, network integration, use of BAT, choice of fuel,...	Emission reduction through the choice of a technology with lower CO2 emissions	Replacement of coal power plant by CCGT plant. The impact of this measure will be assessed based on the available information on the projects that needed authorization and the decisions that have been taken.
6	**EC-A05**	promotion of energy efficiency of electric appliances	The Federal Government supports initiatives to assess the effectiveness of labels to inform consumers correctly. The Flemish Region and the Region of Brussels Capital offer bonuses for buying efficient appliances.	The Federal Government supports initiatives to assess the effectiveness of labels to inform consumers correctly.	Reduction in emissions due to modified choices of appliances as a consequence of clearer labels as a result of the label assessment	Not estimated (the savings are too speculative).
7	**EC-B04**	Improve the information available to the consumer on the environmental impact of products	The federal government develops methodologies (indicators, standard...) for consumer protection as part of the information on environmental impacts. A revision of the code of advertising environment is also planned.	The federal government develops methodologies (indicators, standard...) for consumer protection as part of the information on environmental impacts. A revision of the code of advertising environment is also planned.	Reduction in emissions due to modified choices of appliances as a consequence of clearer labels as a result of the methodology development	Not estimated (the savings are too speculative).
8	**EC-B01**	Financial incentives for the rational use of energy (RUE) and RES	Tax deduction and subsidies have been granted for a part of the cost of investments aiming to increase energy efficiency (including the use of renewable energy resources).	Tax reductions for the purchase of energy saving investments, including the use of renewable energy sources.	Emission reduction due to the increased purchase of the energy saving investments concerned.	No early replacement of equipment. Without the measure, the equipment purchased would have been the average new equipment on the market. Different other assumptions, depending on type of energy savings.

No.	Name of national measure		Description of national measure	Description of federal part of the national measure	Estimated impact on emissions	Assumptions
9	**EC-B02**	Specific constraints on boilers	The federal government will set standards for pollutant emissions (NOx, CO and PM) and performance for boilers, stoves and heaters coal. The 3 regions have regulated the maintenance of boilers.	The federal government has decided to set standards on the efficiency of wood stoves and coal heating systems.	The emission reduction results from the improved efficiency of stoves and coal heating systems.	Impact neglected, as it essentially concerns wood stoves and emissions from biomass are not taken into account for the Kyoto protocol commitment.
10	**EC-B03**	Specific RUE aid for unprivileged people	Funds are available for the energy improvement of housing for disadvantaged people via cheap loans.	Funds are available for the energy improvement of housing for disadvantaged people via low interest loans.	Emission reduction resulting from the investments funded by the FRGE fund	Emission reduction is proportional to the cumulated amount of money awarded by the fund. If possible, emission reduction factors will be based on previously completed projects.
11	**EC-C01**	Using a third investor funds in the public sector	Fedesco (Energy Service Company) will invest in projects for which energy reduction would be profitable, but the investment cost for the owner or building administrator is too high. The savings on the energy bill will first be used to reimburse ESCO and will then benefit the client.	Third party financing of energy saving investments (excluding renewable energy production)	Emission reduction resulting from the energy saving investments funded by Fedesco	Renewable energy production is excluded here, as it is already the subject of OB-B01. Emission reduction is proportional to the cumulated amount of money invested by Fedesco for energy savings. If possible, emission reduction factors will be based on previously completed projects.
12	**IP-A06**	Specific financial measures and ecology premiums	Companies enjoy a tax advantage when they invest in energy saving. As for regions, they distribute bonuses for sustainable energy use.	Level of tax deduction for energy saving investments by companies increased in 2009	Increased emission reduction resulting from the increase in increase in energy saving investments due to the higher tax deduction level	Not estimated, impact neglected.
13	**IP-B01**	Reducing the use of fluorinated greenhouse gases : HFCs, PFCs	The three regions recently adopted or will soon adopt regulations related to stationary applications containing refrigerant gases (refrigeration, air conditioning and heat pump equipment). They have already adopted regulations aimed at recognition of those responsible for the installation and maintenance of applications containing refrigerant gases and systems to protect against fire containing fluorinated gases or gases that deplete the ozone layer.			
14	**TR-A01**	Mobility plans at local level	The plans aim to optimize the movement of passengers and limit the use of fossil fuels (adaptation of regulations on the layout of road systems, signage, etc., to increase the traffic speed and enhance the safety of cyclists).	The federal government makes available for companies diagnostic tools that can serve as a basis for setting up company transport plans.	Extra emission reduction resulting from the availability of federal diagnostic tools for setting up company transport plans	Not estimated (impact is very indirect and there is overlap with financial incentives to promote public transport, carpooling, … for commuting).
15	**TR-A02**	Improve and promote public transport	Large infrastructure projects are implemented in cooperation between different authorities (RER, Diabolo project, ...) to strengthen transport capacity and quality of service (enhancing timeliness, safety, accessibility and information to travelers). SNCB must increase annually over the period 2008-2012, the number of passengers transported by 3,8% to achieve a growth of 25% over the period 2006-2012. The pricing policy is also adjusted. The combinations public transport and other means of soft travel are promoted through awareness raising campaigns. Adaptation for regional transport companies are in place too (network, speed, access, car-sharing...).	Through Royal Decrees of 29 June 2008, the management contracts of the 3 companies of the SNCB group impose a 3,8% annual growth in the number of passengers transported (to achieve 25% over the period 2006-2012), to be reached through investments in infrastructure to strengthen transport capacity and quality of service (enhancing timeliness, safety, accessibility and information to travellers), the pricing policy (free transport for children < 12 years old and price reductions for other categories of passengers), the promotion of combinations between railway and other soft transport modes through awareness raising campaigns.	Emission reduction resulting from the imposed increase in passengers transported, assuming this increase is due to a modal shift from cars to railway	The increase in passengers transported corresponding to the management contracts' objectives is entirely allocated to the federal measure. It is only due to a modal shift from cars to railway. The average distance travelled per passenger-km is the same after the measure Use of average emission factors per passenger-km for cars and railway. The average number of persons per car replaced by rail way is 1,2

No.	Name of national measure		Description of national measure	Description of federal part of the national measure	Estimated impact on emissions	Assumptions
16	**TR-A03**	Promoting the bicycle use	Travel between home and work done by bicycle are immune from taxes and social charges to a maximum of 0.15 €/km. Measures are taken to improve security (bike track, street plan, parking, marking ...) and service (repairs, rentals, access to bus / train / tram ...)	The allowance paid by employers for home-work travel by bicycle is free of tax and social security charges up to 0,15 €/km (Art. 38 of the Income Tax Code). Besides, home-work travel expenses for using a bicycle are deductible at the lump sum rate of 0,15 €/km (Art. 66bis of the Income Tax Code, applicable from the revenues of 2001). In its management contract, the SNCB holding company committed itself to the promotion of the use of bicycles, in particular through an objective of 78000 parking spaces for bicycles in stations, compared with 59000 in 2008.	Overall emission reduction resulting from the increase in bicycle use for home-work travel	The total emission reduction resulting from the modal shift from car to bicycle between 2005 and 2008 is allocated to this measure. The bicycle replaces car travel in an average car of the car stock, with on average 1,2 persons per car. Note that this impact includes the impact of measure OB-C03.
17	**TR-A04**	Promoting multimodal systems for goods	For goods, development of multimodal platforms occur through the improvement of river and rail transport (logistics area, infrastructure, investment, standard, ...).	The Federal government supports the NAIADES program of the European Commission to promote inland navigation. This includes fiscal support for the modernisation of the Belgian fleet : when selling a vessel, no taxes for capital gain have to be paid if the money will be reinvested in a new vessel. The Federal government also supports multimodal transport of goods via financial support for transport of goods via rail for distances below 300 km.	Emission reductions from modal shift in transport of goods occurring as a result of the measure	Baseline is the average emission factor of transport via road, expressed as tonne- km.
18	**TR-A08**	Free public transport for commuters	The federal and regional policies to promote modal shift encompasses a series of measures like free train service for commuters, extension of the tax deduction for expenses incurred for home-work travel when using alternative transport, etc…	To achieve free public transport by train to and from work for all employees, the Federal government has decided in 2008 to prolong the 80/20 system for private sector employees until 2012. In this system, 80% of the season ticket of the SNCB is paid by the employer and 20% is paid by Federal government. The system of free commuting by train for employees of the Federal government has also been extended until 2012.	Overall emission reduction resulting from the increase in passengers transported through the modal shift occurring from cars to railways	Includes the impact of measure OB-C02 (partly) and is included under measure TR-A02.
19	**TR-B01**	Promotion of car-pooling	The advantage of carpooling is to limit the vehicle traffic and as a result congestion. This system is supported fiscally. Parking spaces are specially designed for this purpose.	Home-work travel expenses for using car pooling are deductible at the lump sum rate of 0,15 €/km, up to a maximum distance of 25 km (later increased to 50 and 100 km one-way) (Art. 66bis of the Income Tax Code, applicable from the revenues of 2001).	Emission reductions resulting from the shift from individual car to car pooling since 2005	Car-poolers would have used their individual car as alternative. In absence of the measure the proportion of car poolers would have stayed constant.
20	**TR-B03**	Promote teleworking	Teleworking contributes to the reduction of road traffic during rush hours (congestion) because the worker stays at home and is especially effective if he lives far away from his workplace. Several projects are ongoing and legal adjustments are yet to implement. Tax incentives are expected to encourage companies.	Tax incentives for teleworking are being considered but have not been decided yet.		Not estimated, because no concrete decision on implementation. This measure does not cover OB-C04, which is also on teleworking.
21	**TR-B05**	Eco-driving	Eco-driving is incorporated in the qualification and training of professional drivers (trucks, bus, cars...).	This measure on eco-driving corresponds to the application of directive 2003/59/EC, on the initial qualification and periodic training of drivers of driver licence categories C (trucks) and D (buses). It consists in the introduction of eco-driving in the list of subjects of the qualification tests and the periodic training for the Certificate of Professional Competence (CPC).		In 2012, 40% of the professional drivers will have had an initial qualification or a periodic training. Savings assumed to be 0,5% of diesel consumption for heavy duty vehicles (see explanation in report). Linear interpolation between 2008 (zero impact) and 2012.

No.	Name of national measure		Description of national measure	Description of federal part of the national measure	Estimated impact on emissions	Assumptions
22	**TR-C01**	Tax deduction on the purchase of clean vehicles	Tax reductions are linked with levels of CO2 emissions when purchasing new clean vehicles. Tax deductions are also possible for company cars.	Since 1 January 2005, the solidarity contribution (a contribution paid by employers for provide a company car) is calculated based on CO2 emissions. Since 2006, the purchase of environmental friendly cars is promoted via a tax advantage. For cars with a CO2 emission of less than 115 g/km, 3% of the purchase price can be recovered via a tax reduction. For cars with a CO2 emission of less than 105 g/km, 15% (with a maximum of 3280 €) of the purchase price can be recovered. Additionally, a tax reduction of 150 € is given since 2007 for new diesel cars equiped with a particulate filter and a CO2 emission of less than 130 g/km and particulate emission of less than 0,005 g/km. Finally, for companie cars purchased from 1 January 2007 onwards, the deduction from the corporation tax of all expenses (except fuel) will be between 60 - 90% depending on CO2 emissions. Actions were taken to increase the inspections on emissions of private and company cars.	Difference in emission between cars with low emission and cars with average emission.	Without the measure people would have bought the same category of car. Free-rider is be assessed based on new car registration statistics before implementation of the PAM.
23	**TR-C02**	Promoting the purchase of clean vehicles	Advertisements must mention fuel consumption and CO2 emissions. The Walloon Region has established a bonus/malus system for the purchase or replacement of vehicles more environmentally friendly.	The Federal government takes all necessary actions to implement the Royal Decree of 5/9/2001, which describes the correct representation of fuel usage and CO2 emissions in advertisements, The annual publication "Guide CO2 de la voiture"/ "CO2-gids van de auto" provides objective information and allows comparisons among all car models available on the Belgian market with respect to CO2 emissions, fuel type and consumption and possible tax advantages.		Not estimated. The impact of this measure is assumed to be included under that of measure TR-C01.
24	**TR-D01**	Promotion of biofuels	The Federal Government has authorized the financing of certain quantities of bioethanol and biodiesel to be mixed with fossil fuels. Pure rapeseed oil has also tax exemption under certain conditions. The production of biofuels is subject to a specification which sets environmental criteria. The minimum share of biofuels in the market is set at 5.75% for 2010.	The Federal government has decided a tax exemption for certain amounts of bioethanol and biodiesel, to be mixed with fossil fuels. Since 10 March 2006, pure vegetable or plant oil are also free of taxes. Pure rapeseed oil also has a tax exemption, but only if the producer sells directly to the end user or when rapeseed oil is used for vehicles in public transport. E85 biofuel (85% bioethanol and 15% fossil fuels), which is not regulated, can be used via a separate distribution network only accessible to end users explicitly involved in a specific project. As the tax exemptions did not produce satisfactory results, the Federal government has decided, on 8 May 2009, to oblige by law petroleum companies to blend 4% biofuels in the road transport fuels put on the market from 1 July 2009.	Difference in emission between fossil fuels and biofuels, for the total expected penetration of biofuels.	The entire penetration of biofuels is ascribed to this measure. The baseline is the average emission factor of fossil fuels.
25	**AG-C02**	Preservation of the ecological stability of forests	The implementation of these policies results in the preservation of land, limiting changes in land use and consequently the loss of soil carbon. Monitoring is provided by including wood certification criteria of sustainability. certification is part of a logic of buying environmentally friendly.	On 18 November 2005, the Federal government agreed on a circular letter regarding sustainable wood. This circular letter enforces the Federal government to purchase only certified wood from March 2006 onwards. FSC, PEFC and other equivalent certifications are considered suitable. The Federal government has decided on several actions to prevent the import and sales in illegal wood and to increase the control and penalization of this trade. This was done by activating a new contact group FLEGT and structural cooperation between Federal administrations of Environment and Finances.	Emission reduction from land use changes.	Not estimated. Impact in Belgium negligible.

No.	Name of national measure		Description of national measure	Description of federal part of the national measure	Estimated impact on emissions	Assumptions
26	**AG-D04**	Quality standard of solid biofuels	The Federal Government has decided to draft a royal decree on quality standards of pellets.	The demand for solid biofuels has increased. Low quality of solid biofuels however, could reduce the efficiency of biomass boilers. The Federal government has decided to formulate a Royal Decree on quality standards of pellets.		Not estimated. Emissions from biomass are considered zero for the Kyoto Protocol, so increases in efficiency do not contribute.
27	**AG-E01**	Monitoring of biomass	Different inventory systems are promoted to better manage resources in biomass in the country.	Federal government has established a national observatory for biomass, in cooperation with the regions, with following assignments: collect (and calculate) all useful information on biomass fluxes in Belgium and between Belgium and other countries; harmonise methodologies for collecting information among the different actors in Belgium; draft an annual biomass balance and report possible problems with respect to availability and collection of statistics, This observatory must also determine the suitability of a national biomass strategy,	Emission reductions from increased usage of biomass.	Not estimated (a possible impact is only indirect, by making available better information for other measures).
28	**WA-A01**	Minimise quantity of waste incinerated or landfilled	The Federal Government has a system of environmental taxes to discourage disposable packaging and utensils. The regions have drawn up plans for reducing the volume of household waste by promoting reuse, recycling and sorting lines. Biogas is increasingly valued	The objective of this measure is to reduce the volume of non-recyclable waste. From 1 July 2007, the price of non-returnable packaging is increased via a system of different ecotaxes (on plastic bags, plastic and aluminium foil, ...). This will increase the use of reusable packaging and decrease the volume of waste.	Direct impact: reduced emissions from waste incineration. Indirect impact through increased recycling (fuel consumption for transport, for cleaning…).	Not estimated. Impact negligible.
29	**SE-A01**	Climate change awareness	The population is sensitive to climate change by many media channels (website, brochures, radio spot, ...). Investigations are conducted and the results are taken into account to guide future action.	Federal government communicates via brochures and guides, campaigns in media and a website www.klimaat.be / www.climat.be. These communication channels are used to spread information on climate change, situation in Belgium, decisions of Federal government and concrete actions that may interest general public.	The impact on emissions lies for a great deal in the fact that it makes the other federal PAMs more effective. In that sense it is an iindirect impact, which is dificult to quantify in isolation.	Not estimated. Partly included under the other federal measures (e.g. EC-B01 and TR-C01) of which it increases the awareness. The impact on behaviour is neglected.
30	**SE-A02**	Promotion of rational use of energy and renewable energy applications	The federal government and the regions have made available to consumers some Internet sites, brochures and campaigns to make more sustainable purchases linked to CO2 emissions. In the field of construction, aid and existing premiums are included. Information points also exist.	Consumers are informed on the CO2 impact of goods through two important channels. 1) The Federal government publishes annually information on CO2 emissions, fuel use, … of cars. 2) On the website www.energievreters.be / www.energivores.be the energy consumption and CO2 emission of electrical appliances and other products (wars, insulation, ...) can be calculated; and a selection is given of the cleanest and most efficient models, based on a set of personal criteria. Building and renovation professionals have access to a portal, hosted by the Federal government, with useful information on legislation, premiums, ...	The impact on emissions lies for a great deal in the fact that it makes the other federal PAMs more effective. In that sense it is an iindirect impact, which is dificult to quantify in isolation.	Not estimated. Partly included under the other federal measures (e.g. EC-B01 and TR-C01) of which it increases the awareness. The impact on behaviour is neglected.
31	**SE-A03**	Environmental Care at School (MOS project)	Teaching tools for schools have been developed. Training for teachers are in place. Students can achieve concrete projects to improve the energy performance of their school.	In January 2007, the Federal government and WWF launched the educative project “In de weer voor het klimaat”/ “Le climat, c'est nous”, designed for primary and secondary school teachers and students.	The impact on emissions lies for a great deal in the fact that it makes the other federal PAMs more effective. In that sense it is an iindirect impact, which is dificult to quantify in isolation.	Not estimated. Partly included under the other federal measures (e.g. EC-B01 and TR-C01) of which it increases the awareness. The impact on behaviour is neglected.
32	**SE-A07**	Action to support local initiatives	The various governments provide financial support to local initiatives mainly in projects related to energy (events related information, training and demonstration).	Financial support for local initiatives to increase public participation and awareness on climate change.	The impact on emissions lies for a great deal in the fact that it makes the other federal PAMs more effective. In that sense it is an iindirect impact, which is dificult to quantify in isolation.	Not estimated. Partly included under the other federal measures (e.g. EC-B01 and TR-C01) of which it increases the awareness. The impact on behaviour is neglected.
33	**SE-A08**	Urban Policy	Large cities concentrate particular problems specific to their development and needs for energy and transport which require a targeted approach.	In 1999; Federal government created a specific policy for large cities to develop a harmonised development of cities that contribute to the economic growth of the nation.	No evidence of a positive impact on emissions	Not estimated. No evidence of a positive impact on emissions
34	**OB-A01**	Sustainable public procurement	A catalog of sustainable procurement (with more than 10 categories) is available on the Internet for public markets (federal initiative). It covers office supplies, computers, vehicles… The regions also have their own guidelines.	Via the website http://www.guidedesachatsdurables.be/, the Federal government recommends the purchase of products which are environmentally friendly and produced in socially accepted circumstances.		Not estimated. The main emission reductions are included under other federal measures (e.g. OB-C07) and are too speculative.

No.	Name of national measure		Description of national measure	Description of federal part of the national measure	Estimated impact on emissions	Assumptions
35	**OB-A02**	Optimization of catering on the basis of sustainability criteria	A pilot project to promote sustainable food at a Federal canteen is underway. The aim is to encourage sustainable procurement in this sector too.	A pilot project to promote sustainable food at a Federal canteen is underway. The aim is to encourage sustainable procurement in this sector too.		Not estimated. As far as the climate is concerned, the measure concentrates on foot miles, which essentially happen abroad. Besides, the project is only a pilot one.
36	**OB-A03**	Establishment of an environmental management system	The federal government has decided to certify EMAS all its own services and the other public services (as SNCB). In Brussels, environmental management is also developed via the eco-dynamic enterprise label (see SE-C05).	The federal government has fixed as objective that by 2007 all public services should be EMAS certified. EMAS certified entities set themselves objectives on the reduction of their energy consumption and an increasing use of bicycle and public transport for their emplyees. Besides, the management contracts of the SNCB group of companies foresee the establishment and implementation of an environmental policy plan.	Emission reductions resulting from the reduced energy consumption and from the modal shift towards the use of bicycle and public transport, for the EMAS certified public services	The impact of EMAS certification is partly covered by measures EC-C01, OB-C02 and OB-C03. The impact of the part not covered by other measures is estimated assuming EMAS certification induces a 5 % reduction in energy use per employee compared to the baseline consumption.
37	**OB-B01**	RUE in public buildings, photovoltaic electricity production	The federal government offers its roof areas for solar panels, installs solar panels himself and also public enterprises (cf. SNCB). Wind turbines are concerned too.	In March 2007, the Federal government decided an objective of 1 km² of photovoltaïc panels on roofs of buildings of the Federal government. This will be achieved by 3 measures: 1) roofs will be made available for installing PV panels. 2) Installation of PV panels by government, via Fedesco (2 M€. will be invested). 3) the three companies of SNCB group have committed themselves to consider building and install renewable energy equipment (e.g. solar or wind) via partnerships.	Lower emissions from electricity production, through replacement of fossil electricity production by renewable energy production (PV panels and wind)	On average … m2 (corresponding to… kW or …. kWh) are installed yearly. This number will be calculated from the available budget of Fedesco for PV panel installations. Average emission factor of replaced electricity production is … g/kWh. Linear trend starting from 10000 m2 in 2008 (Note: Fedesco has announced completed and ongoing projects for 13200 m², 1,3 % of its objective).
		Buying green electricity	RW and FR already use green electricity suppliers. The government has initiated discussions in this direction.	The Federal government is studying the possibility to buy a certain percentage of green electricity for all the buildings of the Federal administrations.		Not estimated, because no concrete decision on implementation
38	**OB-B02**	Use of the third investor	Via Fedesco, investment in work in public buildings are made and may be reimbursed based on energy savings generated (see EC-C01)	Via Fedesco, investment in work in public buildings are made and may be reimbursed based on energy savings generated (see EC-C01)		Included under OB-B01 and EC-C01
39	**OB-C02**	Stimulating the use of transport alternatives	Free public transport is available to all officials. The use of bicycles is also compensated. Some structures have a service bicyle park. Most government buildings are easily accessible by public transport.	All Federal employees benefit from free public transport, to and from work. Some federal public services have a bicycle park for employees to cover small distances. New buildings are preferentially built or bought near railway stations.	Emission reduction resulting from the imposed increase in passengers transported, assuming this increase is due to a modal shift from cars to public transport	Calculated based on number of employees benefiting from free public transport, assuming that it replaces transport by car, with the current average number of persons per car. For train, this is completely incorporated in TR-A08.
40	**OB-C03**	Promotion of bicycle use	Mileage allowance is granted to officials who use their bicycles between home and work.	Mileage allowance is granted to officials who use their bicycles between home and work.	Overall emission reduction resulting from the increase in bicycle use due to the modal shift from car or public transport to bicycle as a result of the measure	Included under TR-A03.
41	**OB-C04**	Promotion of teleworking	Voluntary teleworking has been introduced in the federal public service (400 employees involved in mid-2008). An annual report gives an overall assessment of the system. The WR has launched a pilot scheme linked to a CO2 balance.	In a Royal Decree (November 2008) teleworking is allowed for Federal civil servants. 15 Federal civil services have imposed teleworking (situation mid 2008) and about 400 employees are involved.	Emission reduction from a decrease in km commuted. Emission factors are used for both car and public transport	We assume that people teleworking generally use both car and public transport for commuting, similar to non-teleworkers. We assume that they commute further than non teleworkers. Baseline is weighted average of emission factors for commuters (i.e. cars, public transport).
42	**OB-C07**	Purchase of clean vehicles	The renewal of vehicle fleets of public authorities is subject to environmental criteria included in the purchase specifications. Short or medium term objectives were defined. (see TR-C02/C05)	In 2004, environmental criteria were included in the purchase specifications of vehicles for Federal institutions (including Federal civil services, federal public and scientific organisations). This was put forward in a circular letter, that stipulates that 50% of vehicle fleet must be conform the environmental specifications. February 2008 a revision of the circular letter was requested.	Emission reductions obtained by buying clean cars compared to average, similar sized car.	Baseline is average emission of car from the same category.

5 CALCULATIONS

5.1 Excel template

Emission reduction calculations have been carried out only for the most important PAMs, for which an Excel template has been used. The list of Excel templates that have been established is given in Annex 2.

The impact of the measures for which no separate calculations have been performed is either included under another measure or not estimated (generally because it is not easy to estimate and not very significant). The situation for each measure is described in the next section.

The Excel template is used for the detailed calculation of the GHG emission reduction (in terms of CO_2 equivalents) for each of the 5 years in the period 2008-2012.

A common format is used for each PAM, adjusted for each PAM based on the specificities and/or available data for the calculation of the emission reduction (both the complexity and the level of detail needed can differ considerably from one measure to the other). Each Excel file includes a description of the hypotheses/inputs needed.

For clustered measures, the reduction is first calculated at the clustered level, and then an estimate for the division between the linked measures has been made, based on assumptions discussed in the steering group.

5.2 Overview by measure

5.2.1 EP-A01 & EP-A05 Offshore wind energy

Description. With a view to ensuring the placing on the market of a minimum volume of green electricity, a system of green and CHP certificates was established, both at the regional and federal level. Electricity suppliers are obliged to sell a minimum amount of electricity from renewable energy sources. A minimum price has been fixed for green certificates. The federal level ensures a minimum price guarantee.
On 21 March 2004, the federal Council of Ministers set a target of 2000 MW for electricity from offshore wind. An assessed contribution of the grid operator is introduced (financing for network expansion, purchase of certificates). The federal government guarantees project investments in case of interruption by authorities. In 2008, the federal government has also decided to simplify procedures for wind energy projects.

Assumptions & calculation. The general approach used to calculate the impact of this measure on CO_2 emission reductions is:

$$C * H * EF_{CCGT}$$

With:

C	the average installed capacity
H	the equivalent number of working hours at full load during one year
EF_{CCGT}	the emission factor of a CCGT installation.

Upon request of the steering committee, we have assumed that the capacity of the first three currently authorized wind farms (C-Power, Eldepasco and Belwind)[4], i.e. 846 MW, would be available at the end 2012. We have then assumed a linear increase between end 2008 (0 MW) to end 2012 (846 MW)]. For offshore wind, a projected 3250 working hours (equivalent full loas) was used [4].

Results. With a projected capacity of 846 MW offshore wind by the end of 2012 and a mean annual 3250 working hours, emission reductions are estimated to increase to 914 kton CO_2 in 2012, with a cumulative emission reduction of 2090 kton for the period 2008-2012. Possible delay in the projects (due to the financial crisis) will have an enormous impact on the achieved emission reductions. If only the project of C-power, which is the only one in the building phase, is operational at the end of 2012 (300 MW), the emission reduction in 2012 will be 324 kton CO_2, with a cumulative emission reduction of 741 kton CO_2 for the period 2008-2012 (Figure 3).

[4] A fourth project (Rentel, 288 MW) has recently been approved, but is only expected to start production in 2015 (De Tijd, 5 June 2009).

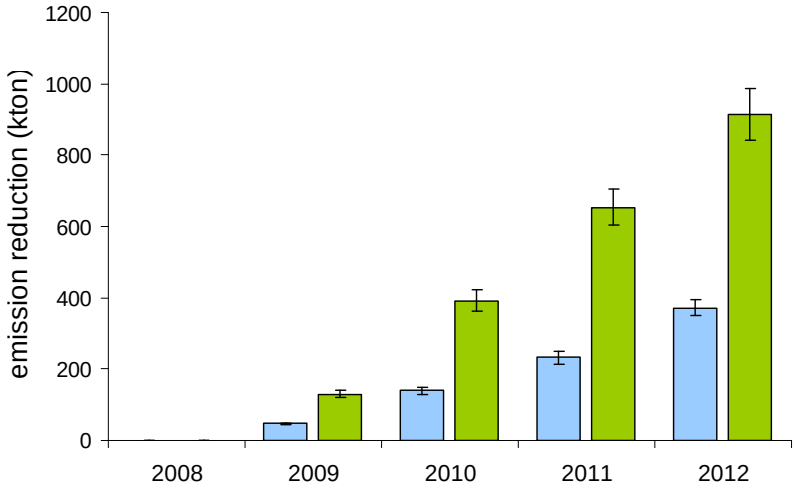


Figure 3. The emission reduction achieved via the installation of offshore wind turbines. In green the scenario if 846 MW will be installed in 2012, in blue if 300 MW will be installed in 2012. The error bars denote the effect of the number of full load hours, the mean value representing 3250 hours the lower error bar 3000 hours and the upper error bar 3500 hours.

5.2.2 EP-A02 & EP-A03 Tax on fossil fuels for electricity production

Description. In addition to the Green Certificates scheme, the Belgian authorities have implemented several measures to promote generation from RES. RES and CHP producers enjoy priority access to the grid in all regions. The regions offer ecology premiums that can be cumulated with the federal measures. The Federal Government has also taken a number of additional measures which reduce the relative cost of electricity from RES. It has established a special excise tax on fossil fuel for electricity production in 2004: 15 €/ton for heavy oil and 8,65 €/ton for coal and an additional 'Cotisation sur l'énergie/Bijdrage op energie' of 3 €/ton of coal. In parallel it has ended the system of excise duty exemptions for coal, coke, lignite and heavy fuel oil, which were previously exempt from excise duty for electricity production (EP-A03).

Assumptions & calculation. The excise tax on coal makes both natural gas and biomass relatively more attractive for electricity production. In this study we have only quantified the impact related to a shift from coal to biomass[5].

For this shift from coal to biomass, there is an overlap with the regional green certificate system, which is an important financial incentive promoting biomass use in coal fired power plants. As explained in chapter 3 on methodology, the impact has been allocated between the federal PAM and the regional ones proportionately to the relative size of the impact of these measures on the cost of electricity production.

[5] The impact of the measures on a shift from coal to natural gas for electricity production is too complex to evaluate here, because the decisions of electricity producers on the fuel mix depend on the coal and gas prices, availability of power plants, the electricity demand level, which all are a function of time.

The taxes on coal result in an increase of electricity production costs from coal estimated at 4,4 €/MWh (see Figure 4). The green certificate system results in a decrease of electricity production costs from biomass estimated at 63 €/MWh. Thus, the difference in the cost of electricity production between coal and biomass was decreased by a total of 67 €/MWh due to these PAMs. Therefore, 6,5 % of the emission reduction was allocated to the federal PAM. Electricity production attributable to biomass co-combustion in coal-fired power plants was 1320 GWh in 2007.

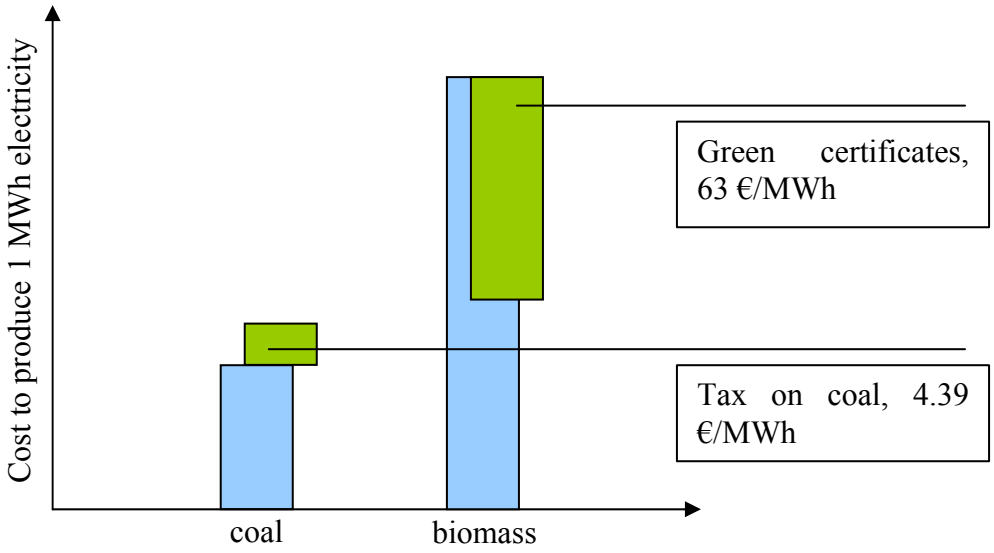


Figure 4. Illustration on how the Federal tax on coal and the regional green certificate scheme respectively increase the cost of producing 1 MWh electricity from coal and decrease the cost for producing a similar amount of electricity from biomass. The overall effect of both federal and regional measures is that producing 1 MWh electricity with biomass has become 67 € cheaper as compared with coal.

The emission reduction for the federal measure is

$$EP_{biomass} * EF_{coal} * AF$$

With:

- EP the electricity production from biomass or natural gas
- EF_{coal} the emission factor of a coal-fired power plant
- AF the allocation factor (share of federal measures in the total impact of federal + regional measures).

Results. Two scenarios were considered. One with no increase of biomass electricity production for 2008-2012 compared to 2007. In this scenario, the annual emission reduction is constant for the entire period at 82 kton CO_2/year, which corresponds with a cumulative emission reduction over the period 2008-2012 of 408 kton CO_2. If we assume a linear increase of co-combustion of biomass (which corresponds to an annual increase of 208 GWh), the cumulative emission reduction increases to 616 kton CO_2.

5.2.3 EP-B01 Prior authorization for power plants > 25 MW

Description. The Belgian allocation plan is the compilation of 3 regional allocation plans. Additionally, prior authorization of the Federal government is required for any new installation that develops more than 25 MW (also for expanding plants). The criteria are based on: needs, network integration, use of BAT, choice of fuel,… The methods of calculating amounts of allowances vary by region.

Assumptions & calculation. Since October 2000, increases or new production capacity for electricity generation exceeding 25 MW requires a formal approval by the Federal government [5]. We assume that the authorization does not have a dissuasive effect and that it does not influence the installations directly.

5.2.4 EC-A05 & EC-B04 Labels on energy efficiency

Description. The Federal Government supports initiatives to assess the effectiveness of labels to inform consumers correctly. It develops methodologies (indicators, standard...) for consumer protection as part of the information on environmental impacts. A revision of the code of environmental advertising is also planned.

Assumptions & calculation. Considering that this is a study into the effectiveness of labels, without additional measures being proposed to change the labelling, no effect of this measure can be quantified.

5.2.5 EC-B01 Financial incentives for rational use of energy

Description. Tax deductions and subsidies have been granted for part of the cost of investments aiming to increase energy efficiency (including the use of renewable energy resources).

Assumptions & calculation. The general approach used to calculate the total CO_2 reduction for this measure per year is as follows:

$$\Sigma_i (N_t * P_i * ER_i * AF_i)$$

With:

Σ	summation for all types of investments eligible under EC-B01
N_t	cumulative number of tax deductions per year since 2005
P_i	% distribution between investments or technologies
ER_i	unitary CO_2 reduction per investment
AF_i	% allocation to federal measure per investment

The investments done in the period before 2008 have also an impact on the later years. The reduction of these previous years is therefore also taken in account for the period 2008-2012. However, only the impact of the measure after the Burden sharing agreement between the regions and the federal government from 2004 are taken into account. This means, the impact of the investments made in 2003 and 2004 are not taken into account.

Free rider and multiplier effect are assumed to compensate each other [6]. The rebound effect is assumed to have no impact. However, in the calculation sheets it is foreseen that the effects can be taken into account when (better) data become available.

The different parts of the formula are discussed in the following sections:

- Number of tax deductions:

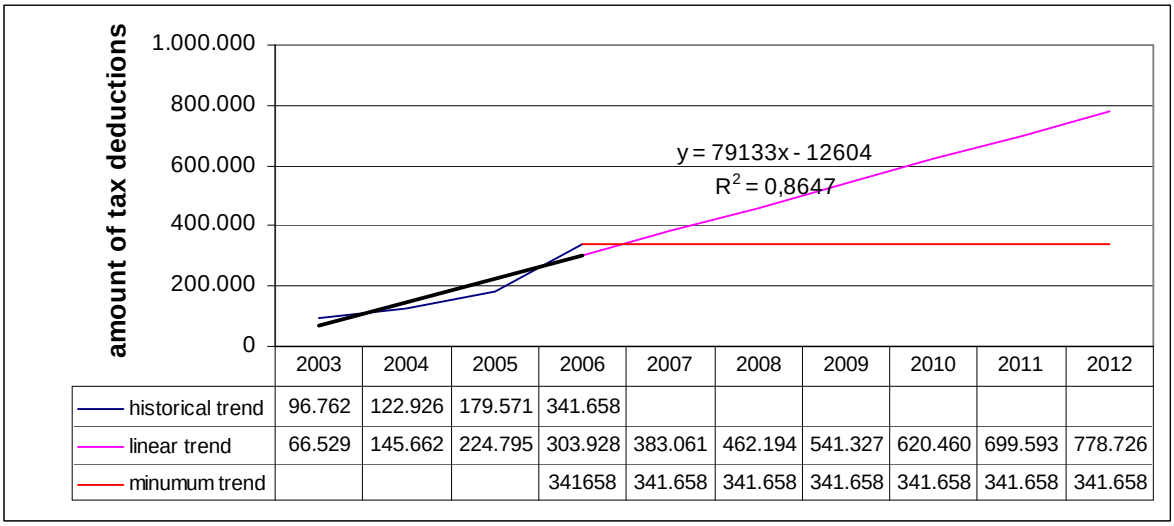
The number of tax deductions within EC-B01 was provided for by the FPS finances [7], for the years 2003 to 2006. The used data are listed in Table 3.

# requests	Bxl	FL	W	TOTAL
2003	5.820	64.700	26.242	96.762
2004	6.969	84.549	31.408	122.926
2005	10.163	122.030	47.378	179.571
2006	19.244	202.557	119.857	341.658
mEUR				
2003	2,80	26,13	11,65	40,58
2004	3,59	66,37	14,35	84,30
2005	5,79	57,57	24,05	87,41
2006	11,65	122,38	54,17	188,20

Table 3: Information on tax deductions (FPS Finances)

An underlying hypothesis for the evaluation of the relative shares of the federal government on the one hand and the Regions on the other hand, is that the number of tax deductions equals the total number of regional premiums (information on total number of regional premiums was requested but not received). The number of premiums is probably higher than the number of tax deductions, so the number of tax deductions can be considered a minimum. An other argument to support this is that in 1 tax form, it is possible to include more than 1 deduction.

A maximum scenario was also considered. The total number of tax deductions is known for 2003 to 2006. Based on these data, a linear trend towards 2007-2012 is proposed as a maximum scenario, as is shown in figure 5.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
historical trend	96.762	122.926	179.571	341.658						
linear trend	66.529	145.662	224.795	303.928	383.061	462.194	541.327	620.460	699.593	778.726
minumum trend				341658	341.658	341.658	341.658	341.658	341.658	341.658

Figure 5: Assumptions on total number of tax deductions (minimum and maximum scenarios)

Since we have no better information, we presume a uniform distribution between minimum and maximum values, as is shown as an example for 2007 in figure 6.

Uniform distribution with parameters:

Minimum	341.658
Maximum	383.061

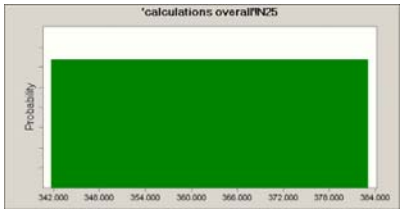


Figure 6: Example of distribution of tax deduction in 2007

- distribution (%) of the total number of tax deductions among types of technology

Unfortunately, no distinction can be made among equipments or technologies in the federal tax deduction data of the FPS Finance. The number of tax deductions per investment is therefore based on the available information on regional premiums (information for some years and/or for some grid managers, listed in the excel files). An average was calculated, which was used for all years (see Table 4).

This average was used as the most likely value. For the calculation of uncertainty ranges a triangular distribution was assumed, based on the ranges seen in the available datasets. The type was distribution is chosen, based on the Good Practice Guidelines of the IPCC from 2000 [8], which state that 'expert judgement' is most likely to coincide with a triangular distribution.

Technology/equipment	% Distribution between total tax deductions (most likely value)	Min %	Max %
Condensing boiler	35,4	Calculated by difference	Calculated by difference
Heat pump	2,6	0	15
Double glazing	36,2	20	52
Roof insulation	11,8	0	50
Thermostatic valves or time regulated thermostats	6,2	0	12
Energy audit	0,1	0	2
Solar thermal systems	6,7	0	15
PV systems	0,1	0	5
Passive houses	0,02	0	1

Table 4: Estimate for the division between technologies in the tax deductions

Since the overall % must be 100%, the occurrence of condensing boiler in the types of tax deductions is made depended on the values of occurrence of the other techniques. An example of a triangular distribution is shown in the following figure for replacement of glass.

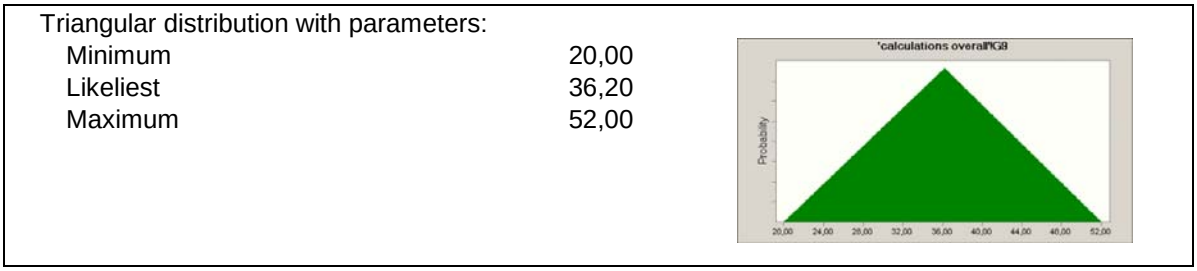


Figure 7: Example of triangular distribution of occurrence of replacement of glass

- unit CO_2 reductions per investment/equipment/technique

In the following sections, the methods and assumptions for the calculation of the unit CO_2 savings are discussed by technology.

→ ***Condensing boiler***

For this group of tax deduction, it is also possible to get a tax deduction for the maintenance of the heating system. However, as a unit reduction we have calculated the replacement of an old system by a new system. The CO_2 reduction per replacement of a condensing boiler by a high efficiency type of boiler is calculated using the following formula:

The reference situation is an 'old' less energy efficient system. Four types of replacement are considered: the replacement of an old system by a system using natural gas (HR+ or HR top) or heating oil (Optimaz, Elite). Woodburner or micro CHP units are not considered.

$$ER_{condensing\ boiler} = \Delta E * EF\ CO_2 = U * A * HDD * 0{,}0864 * (1/\eta_{before} - 1/\eta_{after}) * EF\ CO_2$$

With:

$ER_{condensing\ boiler}$	unit emission reduction for condensing boiler (kg)
E	primary energy need (MJ/year)
EF CO_2	weighted EF, depending on which replacements are made
U	average heat loss coefficient (W/m^2K)
A	average loss area (m^2)
HDD	equivalent number of heating degree days (Kd/year)
0,0864	conversion factor (Ms/day) (=60'*60''*24h/1000000)
η_{before}	system efficiency heating before replacement (%)
η_{after}	system efficiency heating after replacement (%)

In Table 5, the input parameters and their minimum and maximum values are presented. These are mostly based on expert judgement or data from literature, and assumed to have a triangular distribution. The data used for each parameter and the source are described in the Excel file in more detail.

Input parameter	Min	Mean	Max	Source
U - av heat transfer coefficient (W/m^2K)	0,7	0,78	0,86	[9]
A - average loss area (m^2)	283	314	345	[9]
HDD - equivalent degree days	2173	2415	2700	[10]
η - system efficiency				
NG HE+	0,71	0,79	0,87	Estimated
BG HE top	0,83	0,92	1	Estimated
heating oil optimaz	0,71	0,79	0,87	Estimated
heating oil Elite	0,79	0,87	0,96	Estimated
old system	0,64	0,71	0,78	Estimated (based on [11]
% occurence of replacement				
NG old by NG HE+	7	17,7	27	Estimated
NG old by NG HE top		Calculated by difference		
heating oil old by optimaz	39	49,0	59	Estimated
heating oil old by elite	0	0,5	2	estimated

Table5: Assumptions in the calculation of the CO_2 unit reduction for condensing boiler

The Monte Carlo analysis gave a CO_2 unit reduction of 629 kg CO_2, with a standard deviation of 226. The parameter with the highest sensitivity is the system efficiency of an old heating system.

→ ***Heat pump***

The CO_2 reduction for the installation of a heat pump is calculated using the following formula:

$$ER_{heat\ pump} = E_{baseline} - C * H * 3.6/COP * EF\ CO_2$$

With:

$ER_{heat\ pump}$	unit emission reduction for heat pump (kg)
$E_{baseline}$	average CO_2 emission of baseline (kg)
C	average capacity (kWth)
H	number of equivalent full load working hours (h)
EF CO_2	emission factor of CCGT power plant (kg/kWh)
COP	coefficient of performance

The reference situation in this case, is the average fuel mix used for heating purposes in new houses in Belgium.

The correction for electricity use, is based on the seasonal coefficient of performance of the heat pump (COP, ratio of the useful heat to the electricity consumption) and the average CO_2 EF for electricity.

In Table 6, the input parameters and their minimum and maximum value are presented. These are mostly based on expert judgement or data from literature, and are assumed to have a triangular distribution.

Input parameter	Min	Mean	Max	Source
capacity installation (kWth)	6	8	10	Estimated, based on [12]
working hours (h/y)	1500	2000	2500	Estimated based on [12]
seasonal production factor	2,5	3,5	4,5	Estimated based on [12]
CO_2 EF electricity production (kg CO_2/MWh)	0,34	0,38	0,42	See General assumptions
% of occurence in new buildings				
NG ER+	0,41	0,51	0,61	Estimated
NG ER top	Calculated by difference			
heating oil optimaz	0,11	0,21	0,31	Estimated
heating oil elite	0	0,10	0,2	Estimated
Performance η30%				
NG ER+	71%	79%	87%	Estimated
NG ER top	82%	92%	100%	Estimated
heating oil Optimaz	69%	79%	89%	Estimated
heating oil Elite	77%	87%	97%	Estimated

Table6: Assumption used in the calculation of the CO_2 unit reduction for heat pumps

The data used for each parameter and the source are described in the Excel file.

The Monte Carlo analysis gave a CO_2 unit reduction of 2574 kg CO_2, with a standard deviation of 461. The parameters with the highest sensitivity are the installed capacity, working hours and COP.

→ ***Double glazing***

The replacement of less efficient glazing by high efficiency double glazing is calculated as follows:

$$ER_{glazing} = \Delta Q/\eta * EF\ CO_2 = A * HDD * 0{,}0864 * aj * (U_{before} - U_{after}) * EF\ CO_2$$

With

U_{before}	heat loss coefficient glass before replacement (W/m^2K)
U_{after}	heat loss coefficient glass after replacement (W/m^2K)
A	average loss area (m^2) (glass area)
HDD	equivalent heating degree days (Kd/year)
0,0864	conversion factor (Ms/day)*(=60''*60''*24h/1000000)*
aj	weighing factor used in K level calculation (NBN B62 -3011) for glass areas
η	system efficiency for heating
EF CO_2	weighted EF (for the fuel mix of existing houses in Belgium for heating)

The reference situation is single glass.

In Table 7, the input parameters and their minimum and maximum value are presented. These are mostly based on expert judgement or data from literature, and assumed to have a triangular distribution.

Input parameter	Min	Mean	Max	Source
HDD - equivalent degree days	2143	2415	2700	[10]
η (system efficiency)	0,61	0,71	0,81	Estimated based on [11]
U value single glass (W/Km^2)	4,8	5,8	6,8	Estimated
U value High efficiency glass (W/Km^2)	0,6	1,1	1,6	Estimated
U value High efficiency glass (W/Km^2)	0,8	1,3	1,8	Estimated
aj glass	1	1	1	Calculation K level
A - average loss area (m^2)	4,2	9,2	14,2	Estimated based on [9]
fraction of replacement by HE1,1	0	0,5	1	Estimated
fraction of replacement by HE1,3		Calculated by difference		
% of occurrence (energy carrier heating)				
natural gas	34	44,0	54	[13]
heating oil		Calculated by difference		
coal	0	2,8	6	[13]
electricity	2	7,2	12	[13]
other	0	3,0	6	[13]

Table 7: Assumptions on the calculation of the CO_2 unit reduction for replacement of glass

The data used for each parameter and the source are described in the Excel file.

The Monte Carlo analysis gave a CO_2 unit reduction of 739 kg CO_2, with a standard deviation of 189. The parameters with the highest sensitivity are the average loss area and the U value of single glass.

→ ***Roof insulation***

The placing of roof insulation is calculated as follows:

$$ER_{roof} = \Delta Q/\eta * EF\ CO_2 = A * HDD * 0{,}0864 * aj * (U_{before}-U_{after}) * EF\ CO_2$$

With:

ER_{roof}	unit emission reduction for roof insulation (kg)
U	heat loss coefficient glass (W/m^2K) (before and after placing roof insulation)
A	average loss area (m^2) (roof area)
HDD	equivalent heating degree days (Kd/year)
0,0864	conversion factor (Ms/day*)(=60''*60''*24h/1000000)*
aj	weighing factor used in K level calculation (NBN B62 -3011) for roof areas
η	system efficiency for heating
EF CO_2	weighted EF (for the fuel mix of existing houses in Belgium for heating)

The reference situation is a roof that has no insulation.

In Table 8, the input parameters and their minimum and maximum value are presented. These are mostly based on expert judgement or data from literature, and assumed to have a triangular distribution.

Input parameter	Min	Mean	Max	Source
HDD - equivalent degree days	2134	2415	2700	[10]
η - system efficiency (%)	0,61	0,71	0,81	Estimated based on [11]
U roof, non insulated (W/m^2K)	1,5	2	2,5	Estimated
U value after insulation (W/m^2K)	0,15	0,3	0,45	Estimated
aj glass	1	1	1	K level calculation
A - average loss area (m^2)	63	73,7	83	Estimated based on [9]
% of occurence (energy carrier heating)				
natural gas	34	44,0	54	[13]
heating oil	Calculated by difference			
coal	0	2,8	5	[13]
electricity	2	7,2	12	[13]
other	0	3,0	6	[13]

Table 8: Assumption on input parameter for the calculation of the CO_2 unit reduction for roof insulation

The data used for each parameter and the source are described in the Excel file.

The Monte Carlo analysis gave a CO_2 unit reduction of 2159 kg CO_2, with a standard deviation of 345. The parameters with the highest sensitivity are U value of non insulated roof, the system efficiency and the average loss area.

→ ***Thermostatic valves or time regulated thermostats***

The CO_2 reduction of an installation of thermostatic valves or regulated thermostats is calculated as follows:

$$ER_{valves} = \Delta E * \ EF\ CO_2 = A * U * HDD * 0{,}0864 * (1/\eta_{before} - 1/\eta_{after}) * EF\ CO_2$$

With:

ER_{valves}	unit emission reduction for thermostatic valves (kg)
E	primary energy need (MJ/year)
U	average heat loss coefficient (W/m^2K)
A	average loss area (m^2)
HDD	equivalent heating degree days (Kd/year))
0,0864	conversion factor (Ms/day) (=60'*60''*24h/1000000)
η_{before}	system efficiency heating before replacement (%)
η_{after}	system efficiency heating after replacement (%)
EF CO_2	weighted EF for the fuel mix of existing houses in Belgium for heating (kg/MJ)

The parameter η (system efficiency) is the result of different efficiencies: distribution efficiency, emission efficiency and control efficiency. This last efficiency is changed by introducing thermostatic valves or more regulation.

The reference situation is a non efficient regulation system.

In Table 9, the input parameters and their minimum and maximum value are presented. These are mostly based on expert judgement or data from literature, and assumed to have a triangular distribution.

The data used for each parameter and the source are described in the Excel file.

The Monte Carlo analysis gave a CO_2 unit reduction of 256 kg CO_2, with a standard deviation of 576. The parameters with the highest sensitivity are the control efficiencies (η_r).

Input parameter	Min	Mean	Max	Source
HDD -equivalent degree days	2134	2415	2700	[10]
U - average heat transfer coefficient (W/m²K)	0,7	0,78	0,86	Based on [9]
A - average loss area (m²)	283	314	345	Based on [9]
η_d (distribution efficiency)				
with control	0,86	0,95	1	Estimated
without control	0,86	0,95	1	Estimated
η_e (emission efficiencency)				
with control	0,86	0,95	1	Estimated
without control	0,86	0,95	1	Estimated
η_r (control effciency)				
with control	0,88	0,98	1	Estimated
without control	0,86	0,95	1	Estimated
boiler efficiency				
NG HR+	0,83	0,92	1	Estimated
NG HR top	0,96	1,07	1,1	Estimated
HO optimaz	0,83	0,92	1	Estimated
HO optimaz elite	0,92	1,02	1,1	Estimated
Old	0,73	0,83	0,93	Estimated
% of occurence in houses				
NG HR+	Calculated by difference			
NG HR top	0	20	40	Estimated
HO optimaz	0	20	40	Estimated
HO optimaz elite	0	20	40	Estimated
old	0	20	40	Estimated

Table 9: Assumptions for the calculation of CO_2 unit reduction for thermostatic valves and time regulated thermostats

→ ***Energy audit***

No calculations are made here, since the audits give clients information on the measure they can take to reduce their energy use. The impact of the measures itself is included under each of the technologies implemented as a result of the audits.

→ ***Solar thermal systems***

The CO_2 reduction from installing a solar thermal system is calculated with the following formula:

$$ER_{solar} = P / \eta * S * EF\ CO_2$$

With

ER_{solar}	unit emission reduction for solar boiler (kg)
P	average produced annually by solar system (GJ/m²)
S	average size of solar system (m²)
η	efficiency to produce warm water depending on fuel type type/technology (%)
EF CO_2	weighted EF depending on fuel type type/technology (kg/GJ)

The weighted CO_2 EF is based on the division of warm water production systems in the present building stock (estimate based on Flemish survey data). The data used for each parameter and the source are described in the Excel file.

In Table 10, the input parameters and their minimum and maximum value are presented. These are mostly based on expert judgement or data from literature, and assumed to have a triangular distribution.

The Monte Carlo analysis gave a CO_2 unit reduction of 339 kg CO_2, with a standard deviation of 42. The parameters with the highest sensitivity are the average production, size and % of electricity in sanitary hot water production.

Input parameter	Min	Mean	Max	Source
average production (GJ/m²)	1	1,34	1,6	[14]
average size (m²)	0,7	4,2	4,7	Based on info gathered in Refund + [15]
% sanitary hot water (energy carrier)				
natural gas		Calculated by difference		
heating oil	10	17	27	Estimated based on [16]
electricity	15	25	35	Estimated based on [16]
Performance η30%				
natural gas	64	74	84	Estimated
heating oil	62	72	82	Estimated
electricity	83	93	100	Estimated

Table 10: Assumption on input parameters for the calculation of the CO_2 unit reduction for solar thermal systems

→ ***PV systems***

The CO_2 reduction from installing a PV system is calculated with the following formula:

$$ER_{PV} = S * P * EF\ CO_2$$

With:

ER_{PV}	unit emission reduction for photovoltaics (kg)
S	average installation size (kWp)
P	average yearly production (kWh/kWp)
EF CO_2	emission factor of CCGT power plant(kg/kWh)

As reference the electricity production of a CCGT is considered, since PV electricity will most likely replace this type of electricity production. The data used for each parameter and the source are described in the Excel file.

In Table 11, the input parameters and their minimum and maximum value are presented. These are mostly based on expert judgement or data from literature, and are assumed to have a triangular distribution.

Input parameter	Min	Mean	Max	Source
average installation size (households) (kWp)	2	2,5	3	Based on info from [17]
average production (kWh/kWp,y)	500	700	900	Estimated
Emission factor (kg/kWh)	0,34	0,38	0,42	Estimated

Table 11: Assumptions on the input parameters for the calculation of the CO_2 unit reduction for a PV system

The Monte Carlo analysis gave a CO_2 unit reduction of 665 kg CO_2, with a standard deviation of 99. The parameters with the highest sensitivity are: the average production and size.

→ ***Passive houses***

The CO_2 reduction from a passive house is calculated with the following formula:

$$ER_{passive\ house} = (E_{new\ house}) * EF_{new\ house}\ CO_2 - (E_{passive\ house}) * EF_{passive\ house}\ CO_2$$

With:

$ER_{passive\ house}$	unit emission reduction
$E_{new\ house}$	primary energy need of a new house
$E_{passive\ house}$	primary energy need of a passive house
$EF_{new\ house}\ CO_2$	emission factor based on NIS
$EF_{new\ house}\ CO_2$	emission factor based on CCGT

The reference is a new house instead of a passive new house. The division of energy carriers for heating used in new houses was taken from building statistics of Statistics Belgium. It was assumed the passive house need no extra heating, but only passive heating. Ventilation requires a certain amount of electricity. The EF for this electricity is the EF for a CCGT unit.

In Table 12, the input parameters and their minimum and maximum value are presented. These are mostly based on expert judgement or data from literature, and assumed to have a triangular distribution.

Input parameter	Min	Mean	Max	Source
energy need passive house (kWh/m^2)	10	15	20	Based on [18]
energy need new housing (present state) (kWh/m^2)	100	120	140	Based on [18]
average m^2 (new houses)	83	103,6	123	Based on [19]
efficiency η30%	0,81	0,9	0,99	Estimated
% occurrence new housing (energy carrier heating)				
natural gas		Calculated by difference		
heating oil	0	2,1	4,0	Based on [19]
coal	0	0,0	5,0	Based on [19]
electricity	0	2,5	5,0	Based on [19]
other	0	1,1	3,0	Based on [19]
EF electricity production (kg CO_2/kWh)	0,22	0,26	0,3	See General assumptions

Table 12: Assumptions for the calculation of the unit CO_2 reduction for passive houses

The data used for each parameter and the source are described in the Excel file.

The Monte Carlo analysis gave a CO_2 unit reduction of 2610 kg CO_2, with a standard deviation of 306. The parameters with the highest sensitivity are the average m^2 of new houses, the energy need of a new house and system efficiency.

→ ***Overview***

The following data give an overview of the results of the unit CO_2 reduction calculations (Table 13).

Technology	Mean reduction (kg CO_2)	Standard deviation
Condensing boiler	629	226
Heat pump	2574	461
Double glazing	739	189
Roof insulation	2159	345
thermostatic valves or time regulated thermostats	256	576
Energy audit	-	-
Solar thermal systems	339	42
PV systems	665	99
Passive houses	2610	306

Table 13: Calculation of the reduction per technology, with standard deviation based on Monte Carlo analysis (Crystall Ball software)

These results were used as input parameters for the overall CO_2 reduction calculation (as normal distributions, with the calculated standard deviations).

<u>- allocation % to federal PAM:</u>

Since there is a significant overlap with regional premiums (e.g. for condensing boilers) and green certificates (for photovoltaic panels), an allocation between federal and regional measures is in order. The allocation of emission reductions is based on the size of tax the financial support that the PAM (tax deductions, premiums, green certificates for photovoltaic panels).

For some years, data are lacking and estimates were made. The allocation from 2010 to 2012 is kept at the same level as calculated for 2009. This allocation does not take into account the efforts made on promoting, awareness raising, etc. Alternative allocation methods taking into account all efforts could be considered, but were beyond the scope of this study.

In Table 14, the allocation of the reduction to the federal PAMs is given.

% allocated to federal PAM	2005	2006	2007	2008	2009	2010	2011	2012
1. condensing boiler	88	86	92	90	90	90	90	90
2. heat pump	100	83	70	61	62	62	62	62
3. double glazing	77	71	92	80	81	81	81	81
4. roof insulation	94	76	87	74	58	58	58	58
5. thermostatic valves or time regulated thermostats	100	65	88	78	78	78	78	78
6. energy audit	0	0	0	0	0	0	0	0
7. solar thermal systems	100	87	90	69	69	69	69	69
8. PV systems	4	8	17	22	23	23	23	23
9. passive house	0	0	0	100	100	100	100	100

Table 14: Estimate for allocation of reduction to federal PAM

Since this allocation was based on a limited number of data, the uncertainty margins are large. We presume a triangular distribution, with a minimum of 20%points less or 20%points higher than the most likely value as shown in Table 14 (with a maximum of 100% or minimum of 0%). When the most likely allocation is 100% or 0%, a uniform distribution is used between 50% and 100% or 0% and 50%. Examples of the used distributions are given in figure 8.

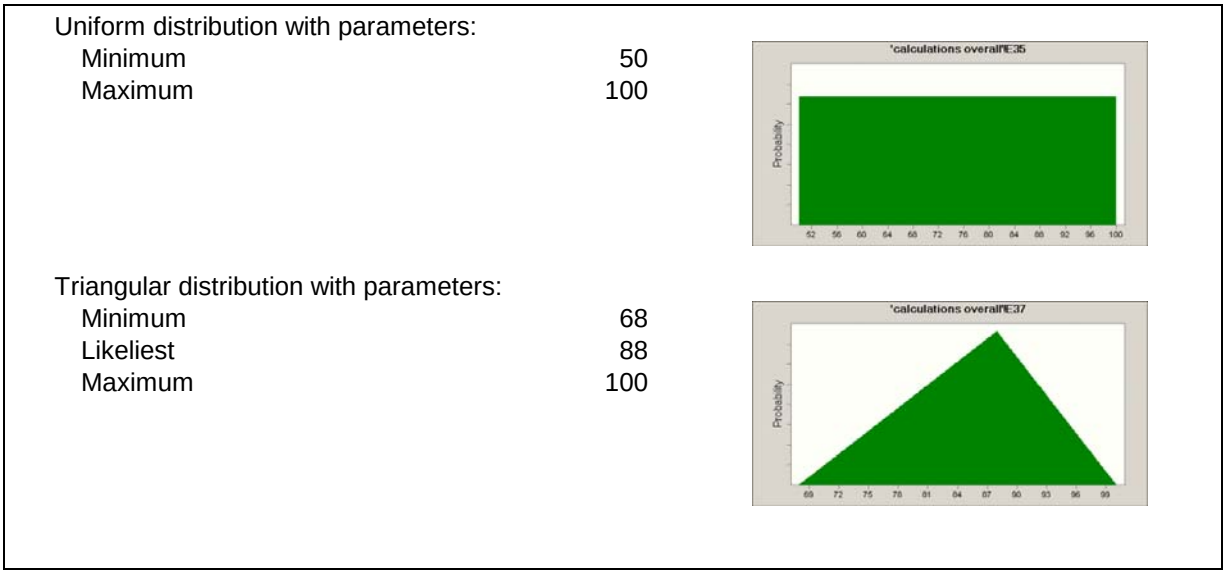


Figure 8: Examples of distribution of allocation % to federal PAM

Overall results.

A Monte Carlo analysis was made, with as output the yearly cumulative CO_2 reduction from 2005 to 2012. The results are cumulative, since we assume that an investment taken in 2005, also has an impact on the CO_2 emissions in later years. This means that all investments in the period 2005- 2007 (before the period considered in this study, namely 2008-2012) have an effect that is taken into account in the overall CO_2 reduction between 2008-2012.

The 95% interval (mean ± 2* standard deviation for a normal distribution) of the overall calculation is listed in Table 15.

	Cumulative reduction of tonnes of CO_2 (tonnes)		
	Min	**Mean**	**Max**
2005	84	154	224
2006	244	426	608
2007	429	741	1053
2008	641	961	1281
2009	831	1183	1535
2010	1010	1420	1830
2011	1186	1674	2162
2012	1361	1943	2525

Table 15: minimum, maximum and mean reduction of tonnes CO_2, (cumulative)

Remark: The overall minimum and maximum was calculated in the Monte Carlo simulation (mean ± 2 standard deviation).

The sensitivity results show that a certain number of input parameters/assumptions are important (in order of importance):

unit reduction glass
unit reduction condensing boiler
unit reduction roof
% roof
unit reduction thermostats
% glass

The unit reductions of the more occurring investments or techniques in the tax deductions are important for the overall uncertainty of the result.

The overall cumulative CO_2 reduction per year in the period 2008-2012 is presented in figure 9.

CO_2 em reduction by federal PAM (kton)			
	min	mean	max
2008	641	961	1281
2009	831	1183	1535
2010	1010	1420	1830
2011	1186	1674	2162
2012	1361	1943	2525

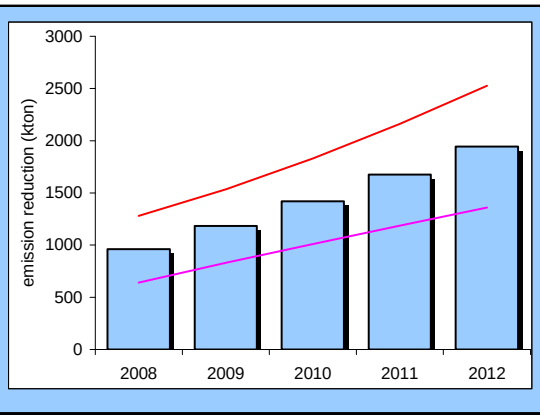


Figure 9: Estimate of the annual CO_2 reduction for the period 2008-2012

To have a check whether or not the data are realistic in terms of the number of equipments installed over the considered period (in this case we take 2003 - 2012), the cumulative number of techniques for 2003 - 2012 was also analysed as output from the Monte Carlo simulation (Table 16). In this case, the years 2003 and 2004 are also taken into consideration in the total number of investments.

The estimates on the total number of replacements or installations seem reasonable compared to the number of Belgian households. A comparison with the statistics from the census 2001 is also possible for insulation: in 2001 2 751 710 households claimed to have double glass; 1 822 391 roof insulation. This means that even with the calculated number of new glazing and insulation of roofs, the total number of houses is still below 4,5 million in 2012.

It would also be interesting to compare the data with the present and projected number of solar thermal installations, PV installations. For example in Flanders on 9/5/2009 (VREG), 18 234 PV installations already received Green certificates, and the number is rising.

Technology	Mean total number 2003-2012	Standard deviation (1)	% of total amount of households in Belgium (2)
Condensing boiler	742.872	476.136	17
Heat pump	117.624	35.840	3
Double glazing	1.143.891	81.882	25
Roof insulation	471.243	118.114	10
thermostatic valves or time regulated thermostats	194.138	27.514	4
Energy audit	9.863	5.882	0
Solar thermal systems	217.701	34.359	5
PV systems	42.632	11.963	1
Passive houses	11.934	8.242	0,3

Table 16: Overview of the number of techniques/equipments installed over the period 2003-2012 (Crystal ball simulation); Remarks (1): the distribution is not always approximating a normal distribution; (2) approximately 4,5 million

Conclusions and proposals to improve the estimates

A good monitoring and evaluation (ex post or ex ante) needs good data and methods.

The estimates would be improved if sufficient, detailed data on types of investments would be available:

- The number of tax deductions per technology (and divided between new houses and existing) should be monitored (also if the deductions include more than 1 technology, this should be registered)
- The regional premium data: the total number per technology, the size of the premium per year: data should be made available

- Alternative allocation methods to deal with overlapping measures should be checked and tested

The estimates would also be improved if the unit reduction could be calculated at a more precise level when data are available:

- data on building characteristics are mostly estimates (U values, loss areas, % of energy carriers used, …)..
- data on the stock of heating systems in place is also based on estimates and expert judgement.
- baseline assumptions (moving or not , compare to what situation, difference new and existing houses, …)

An important source of information in the future might be the energy performance certificates. However, these are mostly based on default values and should be treated with some caution.

On the methodology side, there also could be improvements:

- one of the objectives of the EMEEES project [20] was to propose bottom-up methods to calculate unit energy reductions. At the moment, methodologies for bottom up calculation methods for the monitoring of the energy efficiency directive are still being discussed, also with input from the EMEEES project. The result of these discussions could be used to improve the calculations.

The results (like the number of investments) per technology, should be compared to present data, and projections. This could give a reliability check. Apart from some checks, this has not been performed in detail in this study.

5.2.6 EC-B02 Standards for wood stoves and coal heating systems

Description. The Federal government will prepare Royal Decrees on pollutant emissions (CO and PM) and efficiency for wood stoves and coal heaters. In the NCP, the measure also mentions the definition of quality standards for biofuels for boilers and stoves. These are considered under measure AG-D04.

Assumptions & calculation. In practice the impact of this measure on CO_2 emissions will essentially concern wood stoves. As CO_2 emissions from biomass are not taken into account in the emissions relevant for the Kyoto protocol, the impact of this measure is considered negligible and has not been estimated.

5.2.7 EC-B03 Specific RUE aid for unprivileged people

Description. Funds are available from FRGE (Fund for the Reduction of the Global cost of Energy) for the energy improvement of housing for disadvantaged people via cheap loans. Funds are available for the energy improvement of housing for disadvantaged people via low interest loans. A total of 50 million € is available for the period 2006-2010, but the fund will be increased with 250 million € in the near future. Funds are distributed via local

entities in 7 cities but an increase is expected to 20 cities in the coming 2 years [21]. To date, almost 7 million € have been used.

Assumptions & calculation. Personal communication with FRGE confirmed that there are a significant number of people that have used a loan from FRGE and who also benefited from a tax reduction. To prevent double counting with measure EC-B01 we only included people with a very low income that do not pay taxes and who were not able to profit from a tax deduction. Information of FRGE was used to calculate an emission reduction per euro loaned by FRGE.

Because non-tax payers still may benefit from regional subsidies, an allocation is necessary between federal and regional PAMs. We have used the methodology and information from EC-B01, however, for Flanders subsidies are higher for non-tax payers than for tax-payers. To estimate the financial benefit obtained from FRGE, we used the mean loan for each subcategory (insulation, heat and solar) and calculated the differences in total reimbursement between a loan at an interest rate of 2 % and 10 % for a period of 36 months.

With the information from FRGE, a distinction could be made between investments in insulation (52%, of which 50% roof and 50% glazing), heat (46%, of which 100% condensing boiler and 0% heat pump) and solar (2%, of which 90% PV and 10% solar boiler). Within each group of investments (insulation, heat and solar) the allocation was based upon the amount loaned and information from measure EC-B01. Taking into account the emission reductions for unitary replacements in EC-B01, a weighted emission reduction could be calculated.

It has been decided that people who do not pay taxes or sufficient taxes to benefit from a full tax reduction, will be given tax credits to get financial support for EE investments via federal measure EC-B01 in the future. However, it is difficult to predict how this will affect the number of tax reductions in the future so we do not take this into account into the analysis of EC-B01.

Results. Our assessment shows that each euro loaned by the FRGE corresponds with an emission reduction of 0,185 kg CO_2 of which 0,070 kg CO_2 can be allocated to the FRGE. Considering that in 2008 a total amount of 255100 € was provided in loans by the FRGE, this corresponds to an estimated emission reduction of 17,7 ton CO_2 in 2008. Conservatively we assumed a similar amount of money for all consecutive years, which amounts to a cumulative emission reduction for the period 2008-2012 of 0,27 kton CO_2.

5.2.8 EC-C01 Third party financing for energy saving investments

Description. To improve energy efficiency in public buildings, the Federal government created in 2005 Fedesco. Fedesco is financed by the government and invests in projects to increase energy efficiency via energy performance contracts, energy monitoring systems, PV panels, ... in the 1800 buildings used by the Federal government.

Assumptions & calculation. Not all investments by Fedesco are taken into account in this PAM. Only investments in energy efficiency are considered and not in PV panels. The latter are included under OB-B01. The NCP, lists an objective of Fedesco to decrease CO_2 emissions from public buildings with 22% in 2014 compared to 2007. The CO_2 emissions by public buildings have been very roughly estimated at 600.000 tonnes for 2007 [22]. This objective will be achieved via energy performance contracts, energy scans and audits and

investments to improve energy efficiency [23]. The budget foreseen in the Business plan and actually allocated to Fedesco is given in Table 17. Although 12.5 million € was available in 2008, there were only projects for a total of 8 million € with public services. Based on the information in Table 17, we assume that Fedesco has a 30% backlog compared to their objective. We assume that this will be constant for 2008-2012.

	Budget foreseen	Budget allocated	Actual contracts
2008	12.5 million €	12.5 million €	8 million €
2009	17.5 million €	12.5 million €	12.5 million €[a]
2010	30 million €	21 million €	?
2011	59 million €	?	?

Table 17 Overview of the budget foreseen, allocated and actual contracts with federal public services for 2008-2011. [a] estimation based on personal communication with Fedesco.

Results. Following the objectives mentioned in the business plan and the current backlog of 30% compared to funding and actual projects proposed by Fedesco, an emission reduction of 33 kton CO_2 could be achieved in 2012. Assuming a linear progress in achieving this objective, this corresponds to a cumulative emission reduction of 98 kton CO_2 for the period 2008-2012. If the objective of 22% however would be achieved by 2014, this would mean an estimated emission reduction of 47 kton CO_2 in 2012.

5.2.9 IP-A06 Tax deduction for energy saving investments by companies

Description. For decades, companies have been enjoying a tax advantage when they invest in energy savings, at a percentage tax deduction level that has varied in time. Information from FPS Finance revealed that the annual amount of investments benefiting from this tax deduction ranged between 40 to 180 million €. For 2004, the tax deduction was of 13,5% for energy saving investments by companies (instead of 3,5% for standard investments). For the year 2009 the deduction level has been raised to 15,5% for energy saving investments, while standard investments no longer benefit from a tax deduction.

Assumptions & calculation. As the tax deduction is an existing measure, this PAM is considered as consisting of the net increase in deduction rate in 2009, which amounts to 5,5%.The impact of this increased rate is considered to be negligible. After tax, the pay-back time of an investment is indeed less than 2% shorter than before this increased reduction.

5.2.10 TR-A01 Mobility plans at local level

Description. The federal government makes available for companies diagnostic tools that can serve as a basis for setting up company transport plans.

Assumptions & calculation. The impact of this measure, which is the extra emission reduction resulting from the availability of federal diagnostic tools for setting up company transport plans, has not been estimated separately. It is very indirect and at least partially included under the measures to promote public transport (TR-A02), cycling (TR-A02) and carpooling (TR-A03) for commuting.

5.2.11 TR-A02 Improvement and promotion of public transport

Description. Through Royal Decrees of 29 June 2008, the management contracts of the 3 companies of the NMBS/SNCB group impose a 3,8% annual growth in the number of passengers transported (to achieve 25% over the period 2006-2012), to be reached through investments in infrastructure, the strengthen of the transport capacity and the quality of service (enhancing timeliness, safety, accessibility and information to travellers), the further development of an attractive pricing policy, the promotion of combinations between railway and other soft transport modes through specific investments (parkings spaces for cars and bicycles with safety cameras, lighting…) and awareness raising campaigns.

Assumptions & calculation. For over twenty years, until 1986, the number of train passengers has had a downward trend; after that it stabilised for about ten years and since then it has regularly increased, in particular as a result of the federal government's policies.
The impact of the measure is considered to correspond to the absolute increase in the number of passenger-km by train since 2004, assuming that:

- the imposed objective will be reached (note however that this objective is to be evaluated, and possibly adapted, in 2010, on the basis of the results obtained in 2008 and 2009), with a linear interpolation between 2007 an 2012;
- the impact corresponds to a modal shift from cars to railway on a one-to-one pkm basis;
- the average distance travelled by passenger remains constant (implying that the 25% increase also applies to the distance travelled);
- the average number of persons per car replaced by rail way is 1,2 (the average between 1 and 1,4, the latter being the average for the entire car traffic);
- the emission factor of the car replaced is average emission factor of the car stock;
- for the increased railway traffic (assumed 100% electricity-driven), the emission factor corresponds to a CCGT plant, taking into account electricity T&D losses;
- the allocation to federal PAMs is 100% (the impact of the contribution of regional governments to the financing of train tickets for regional civil servants is neglected);
- the impact that the promotion of railway passenger traffic has on the development of urban public transport is compensated by the impact of urban transport measures (taken by the Regions) on the railway traffic.

The emission reduction is calculated using the following formula:

$$(EF_{car} / 1{,}2 - EF_{rail}) * (Pkm - Pkm_{2004})$$

where:

Pkm: number of passenger-km by train
EF_{car}: emission factor car (g/km)
EF_{rail}: emission factor rail (g/pkm)

Remark: the measure also has a positive impact on traffic congestion, thereby leading to further emission reductions. This second order effect has not been taken into account.

5.2.12 TR-A03 Promoting bicycle use

Description. This federal measure has the following components:
- the allowance paid by employers for home-work travel by bicycle is free of tax and social security charges up to 0,15 €/km (Art. 38 of the Income Tax Code);
- home-work travel expenses for using a bicycle are deductible at the lump sum rate of 0,15 €/km (Art. 66bis of the Income Tax Code, applicable from the revenues of 2001);
- in the management contract of NMBS/SNCB holding, the company committed itself to the promotion of the use of bicycles, in particular through an objective of 78 000 parking spaces for bicycles in stations, compared with 59 000 in 2008.

Assumptions & calculation. The impact of the measure is considered to be the overall emission reduction resulting from the absolute increase in bicycle use for home-work travel observed between 2005 and 2008 in the survey on home-work travel of FPS Mobility, assuming that is increase is due to a modal shift from car to bicycle.
It is assumed that bicycle mobility replaces car mobility in an average car of the car stock, with on average 1,2 persons per car (as for measure TR-A02). Note that this impact includes the impact of measure OB-C03.

The emission reduction is calculated using the following formula:

$$EFcar / 1{,}2 * (Pkm - Pkm_{2004})$$

where:

Pkm: number of passenger-km by bicycle for home-work travel
EFcar: emission factor car (g/km)

The calculation is based on results of the mobility surveys of FPS Mobility on home-work travel, carried out in 2005 [24] and 2008 [25]. Note that this survey only provides percentage numbers of travel for each mode, but not the distances achieved. Therefore some results of the latest mobility survey report for Flanders [26] (where the essential part of the cycling takes place), for the year 2000, have also been used. The details are mentioned in the Excel template.

5.2.13 TR-A04 Promoting multimodal systems for goods

Description. For goods, the development of multimodal platforms occur through the improvement of river and rail transport (logistics area, infrastructure, investment...). The Federal government supports the NAIADES programme (2006-2013) of the European Commission to promote inland navigation. This includes fiscal support for the modernisation of the Belgian fleet : when selling a vessel, no taxes for capital gain have to be paid if the money is be reinvested in a new vessel. For rail, internal intermodal transport (departure and arrival within Belgium) has been supported by federal subsidies from January 2005 until end 2008 (Royal Decree of 30.9.05, later extended to end 2008). This is to be extended for the period 2009-2012 (Programme-Law of 22.12.08, application Royal Decree is still pending). The aim was to help maintain existing rail traffic level and to increase it by 20% over a period of three years.

Assumptions & calculation. Emission reductions from modal shift to inland navigation have not been quantified, as the impact of the measure is only indirect, not easy to evaluate and expected to be marginal.

For the modal shift to rail transport, the traffic relevant for the subsidy has gone up from 257.000 ITU[6] in 2004 to 396.000 ITU in 2008, an increase of 139.000 ITU (54%). An order of magnitude of the emission reduction corresponding to this increase (considering the traffic in 2004 as baseline) can be obtained as follows:

139.000 ITU * 17 t * 150 km * 50 g CO2/tkm = 17,7 kt CO2,

with the following assumptions:

- 17 tonnes transported per ITU (based on figures from [27] provided by SPF Mobility)
- 150 km per trip (source: SPF Mobility)
- 50 g CO2 reduction per tkm (typically, the difference between 80 g/tkm for road transport and 30 g/tkm for rail transport).

However, the actual impact of the measure should be evaluated by comparing the emission level with that of the baseline for the same year, i.e. the emission level that would have taken place in the absence of the subsidies. A study by Policy Research Corporation has estimated that the possibility for internal intermodal transport to survive without subsidies is limited, except for the traffic between Antwerp and Zeebrugge (where the volumes are large) and to and from Athus (where the distances are large), which respectively represented 57% and 12% of the total internal intermodal transport in 2007 [28]. Assuming that without subsidies the remaining traffic would disappear, we consider as baseline for 2008 a number of ITU equal to 396.000 * 69% = 273.000. An order of magnitude of the corresponding emission reduction is:

(396.000 – 273.000) ITU * 17 t * 150 km * 50 g CO2/tkm = 15,7 kt CO2.

It can be noticed that this figure is not very different from the one obtained by comparison with the base year 2004 (17,7 kt CO2). Given that the support is to be extended for the years 2009-2012, although with an annual budget reduced from 30 M€ to 22,5 M€, and that no further increase of the traffic is expected for the coming years (in 2008 and 2009 there has been a decrease, due to the economic crisis), we have kept the same annual emission reduction level of 16 kt CO2 for the years 2008-2012.

5.2.14 TR-A08 Free public transport for commuters

Description. The federal and regional policies to promote modal shift encompass a series of measures like free train service for commuters, extension of the tax deduction for expenses incurred for home-work travel when using alternative transport, etc… To achieve free public transport by train to and from work for all employees, the Federal government has decided in 2008 to prolong the 80/20 system for private sector employees until 2012. In this system, 80% of the season ticket of the SNCB is paid by the employer and 20% is paid by

[6] Intermodal Transport Unit.

Federal government. The system of free commuting by train for employees of the Federal government has also been extended until 2012.

Assumptions & calculation. The impact of this measure is included under measure TR-A02.

5.2.15 TR-B01 Promotion of car-pooling

Description. Carpooling is supported fiscally. Home-work travel expenses for using car pooling are deductible at the lump sum rate of 0,15 €/km, up to a maximum distance of 25 km (later increased to 50 and 100 km one-way) (Art. 66bis of the Income Tax Code).

Assumptions & calculation. As this measure is already applicable from the revenues of 2001, it is not taken into account in this study. Note that the inquiries of FPS Mobility on home-work trips show a small decrease, rather than an increase, of car pooling in Belgium between 2005 and 2008.

5.2.16 TR-B03 Promotion of teleworking

Description. At the request of the Flemish region a consultation with federal authorities through an interministerial committee has been planned in order to examine possible tax incentives for teleworking systems.

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Assumptions & calculation. The impact is considered to be negligible, as there is no concrete decision on implementation at this stage.

Remarks:

- This measure does not cover measure OB-C04, which is also on teleworking.
- Some doubts have been raised about the actual level of energy savings achieved through teleworking, as the saving on transportation fuels is to a certain extent compensated by an increased energy consumption for space heating, when the office remains heated. The main advantages of teleworking seem to lie in a reduction of traffic congestion and an improvement of comfort for the teleworkers.

5.2.17 TR-B05 Eco-driving

Description. This measure on eco-driving corresponds to the application of directive 2003/59/EC, on the initial qualification and periodic training of drivers of driver licence categories C (trucks) and D (buses). The latter has been transposed by a Royal Decree of 4 May 2007. It consists in the inclusion of the optimisation of fuel consumption in the list of subjects of the qualification tests and periodic training for the Certificate of Professional Competence (CPC).

Actions are also foreseen for the general public (e.g. inclusion of a module on eco-driving in the programmes of driving schools), specific target groups (such as sales representatives) and public authorities (e.g. training of town personnel).

Assumptions & calculation. According to Bond Beter Leefmilieu, eco-driving allows fuel savings of 5 to 7% for heavy duty vehicles [www.bondbeterleefmilieu.be/eco-driving/page.php/293]. However. the level of saving depends very much on the traffic circumstances.
The content of directive 2003/59 is in force in Belgium for category D licences since 10 September 2008 and will be in force for category C licences from 10 September 2009. Seven years after these dates of entry into force, all drivers of each of both categories will have had an initial qualification or at least one periodic training. In 2012, this will concern about 40% of the drivers.
It is very difficult to give a precise figure for the energy savings, as there are no surveys on the subject. Given that:

- in Belgium, 60% of the truck traffic (in vehicle-km) is on motorways, where the vehicle speed is mostly constant and regulated by a cruise-control system and where the savings are therefore likely to be very small,
- part of the drivers would already apply eco-driving in the baseline,
- eco-driving is not a compulsory subject of the periodic training,
- this periodic training is not subject to a test,
- drivers do not necessarily apply eco-driving when they have the appropriate qualification,
- a substantial part of the heavy duty vehicle traffic is generated by foreign drivers, who are not concerned by the (Belgian federal) measure,

we have considered as order of magnitude that the saving in 2012 0,5% of the consumption of diesel fuel for heavy duty vehicles, estimated at 90 PJ. As the emission factor of gasoil is 73,3 kg CO2/GJ, this leads to the following estimate :

$$90 \text{ PJ} * 73{,}3 \text{ kg CO2/GJ} * 0{,}5\% = 33 \text{ kt CO2}$$

For the previous years the values were obtained by a linear interpolation between 0 in 2008 and that value for 2012.

5.2.18 TR-C01 Tax reduction on the purchase of clean vehicles

Description. Since 1 January 2005, the "solidarity contribution" (a contribution paid by employers who provide a company car) is calculated based on CO2 emissions. From 1 January 2005 till 30 June 2007, the purchase of environmentally friendly cars was promoted via a tax advantage: for cars with a CO2 emission of less than 115 g/km, 3% of the purchase price could be recovered via a tax reduction and for cars with a CO2 emission of less than 105 g/km, 15% (with a maximum of 3280 €) of the purchase price could be recovered. Since July 2007, this tax reduction (which used to be recovered only after a long delay) has been replaced by an immediate discount on the invoice, of the same amount. Additionally, a tax reduction of 150 € is given since 2007 for new diesel cars equipped with a particulate filter and a CO2 emission of less than 130 g/km and particulate emission of less than 0,005 g/km. Finally, for company cars purchased from 1 January 2007 onwards, the deduction from the corporation tax of all expenses (except fuel) will be between 60 - 90% depending on CO2 emissions.

Assumptions & calculation. Only the impact of the tax reduction and the invoice discount for the purchase of low CO2 emission cars below 115 g/km has been quantified, under the following assumptions:

- Without the measure, buyers would have bought the same category of car.
- The tax reduction/invoice discount does not accelerate the purchase of new cars.
- The free rider effect is taken into account by considering as baseline for each category a number of new cars equal to the number of new car registrations before the implementation of the PAM.
- In the future and up to the end of 2012, the number of new cars benefiting from an invoice discount will continue at the same rate as over the last twelve months.

For each category of clean car, the annual emission reduction is calculated using the following formula:

$$(N - Nb) * (EFb - EF) * Km$$

where:

N	cumulative number of cars with tax reduction or invoice discount
Nb	cumulative number of cars of category < 105 g/km or 105-115 g/km in baseline
EFb	average emission factor of baseline (g/km) (emission factor of average new vehicle in absence of support)
EF	average emission factor of clean car (g/km)
Km	average number of kilometres driven per year

The impact of the Ecobonus in Wallonia (bonus/malus system for the purchase or replacement of more environmentally friendly vehicles, entered into force on 1 January 2008) has not been deducted, because of a lack of data.

The uncertainty on the assessment is large, firstly because neither the future number of cars actually purchased in each category nor, especially, the number of cars purchased in the baseline are known, and also because the actual emissions and mileage of the cars are uncertain.

5.2.19 TR-C02 Promoting the purchase of clean vehicles

Description. Advertisements must mention fuel consumption and CO2 emissions. The Federal government takes the necessary actions to implement the Royal Decree of 5/9/2001, which describes the correct representation of fuel usage and CO2 emissions in advertisements. The annual publication “Guide CO2 de la voiture”/ “CO2-gids van de auto” provides objective information and allows comparisons among all car models available on the Belgian market with respect to CO2 emissions, fuel type and consumption and possible tax advantages.

Assumptions & calculation. The impact of this measure is assumed to be included under that of measure TR-C01.

5.2.20 TR-D01 Promotion of biofuels

Description. The objective of this measure is to ensure a minimum amount of biofuels on the Belgian market (an objective of 5,75% on 31st December 2010 is required by directive 2003/30/EC). The Federal government has decided a tax exemption for certain amounts of bioethanol and biodiesel, to be mixed with fossil fuels. Since 10 March 2006, pure vegetable or plant oil are also free of taxes. Pure rapeseed oil has a tax exemption, but only if the producer sells directly to the end user or when rapeseed oil is used for vehicles in public transport. E85 biofuel (85% bioethanol and 15% fossil fuels), which is not regulated, can be used via a separate distribution network only accessible to end users explicitly involved in a specific project.
In the National Climate Plan, this measure is entitled 'Detaxation of biofuels'. However, as the tax exemptions did not produce satisfactory results, the Federal government has decided, on 8 May 2009, to oblige by law petroleum companies to blend 4% biofuels (by volume) in the road transport fuels put on the market from 1 July 2009. We have included this new decision in this PAM.
The production of biofuel is subject to specifications, defined in the law of 10 June 2006 on biofuels, which sets environmental criteria (energy efficiency, greenhouse gas balances), agriculture (use of pesticides and fertilizers), proximity (shortest distance between production biomass and production unit), etc. (see AG-D04)

Assumptions & calculation. 4% by volume corresponds to 2,7% ethanol in gasoline and 3,7% biodiesel in diesel fuel. The following biofuel content (as % of energy content) has been assumed (see Excel template for more details):

	gasoline	diesel
2008	1,10%	1,10%
2009	1,88%	2,39%
2010	2,66%	3,69%
2011	5,75%	5,75%
2012	5,75%	5,75%

The figures are derived from:
- the situation observed in 2008 and the 1st semester of 2009;
- the federal government's decision of 8 May 2009, assumed applicable from 1 July of 2009;
- for 2011 and 2012, the assumption that the objective of the European directive would be achieved (request of the steering committee).

The annual emission reduction per category of clean car is calculated using the following formula:

$$Cg * EFg * b_g + Cd * EFd * b_d$$

where:

Cg	Gasoline consumption (PJ)
Cd	Diesel consumption (PJ)
EFg	CO2 emission factor of gasoline (kt/PJ)
EFd	CO2 emission factor of diesel oil (kt/PJ)
b_g	Biofuel content of gasoline
b_d	Biofuel content of diesel oil

The entire penetration of biofuels is ascribed to this measure. The baseline is no biofuel content. The impact on emissions from the production of biofuels is not taken into account (note that the biofuels may be imported, in which case these emissions are not to be taken into account for the Kyoto protocol).

For the calculation of upper and lower bounds, a first consideration is that the legal obligation to blend 4% biofuel by volume is limited to 30 June 20011, with a possibility of 2 year extension by government decision, i.e. until 30 June 2013. As lower bound we assume, given the objective of the EC directive, that this obligation will be extended. For the upper bound, we assume that the objective of 5,75% biofuel by energy content of the directive will be reached.

5.2.21 AG-C02 Preservation of the ecological stability of forests

Description. On 18 November 2005, the Federal government agreed on a circular letter regarding sustainable wood[29]. This circular letter obliges the Federal government to purchase only certified wood from March 2006 onwards. FSC, PEFC and other equivalent certifications are considered suitable. The Federal government has decided on several actions to prevent the import and sales in illegal wood and to increase the control and penalization of this trade. This was done by activating a new contact group FLEGT and structural cooperation between Federal administrations of Environment and Finance. The implementation of these policies results in the preservation of land, limiting changes in land use and consequently the loss of soil carbon. Monitoring is provided by including wood certification criteria of sustainability.

Assumptions & calculation. There are no quantitative data available on the amount of certified wood purchased by the Federal government. However, as the wood concerned by this certification would essentially come from abroad, the impact of this measure on emission reductions in Belgium has been considered as negligible.

5.2.22 AG-D04 Quality standard for solid biofuels

Description. The demand for solid biofuels has increased steadily. However, the low quality of solid biofuels reduces the efficiency of biomass boilers. The Federal government has decided to prepare a Royal Decree on the quality standards of pellets for biomass boilers.

Assumptions & calculation. Emissions from biomass are considered zero in the Kyoto protocol commitments. Therefore the effect of this measure on CO_2 emissions has not been taken into account.

5.2.23 AG-E01 Monitoring of biomass

Description. Different inventory systems are being promoted to better manage the biomass resources in the country. The Federal government, in cooperation with the regions, will establish a national observatory for biomass with the following assignments: collect and/or calculate all useful information on biomass fluxes in Belgium and between Belgium and

other countries; harmonise methodologies for collecting information among the different actors in Belgium; draft an annual biomass balance and report possible problems with respect to availability and collection of statistics. This observatory must also determine the suitability of a national biomass strategy.

Assumptions & calculation. Potentially, this measure could have an effect on the emission of greenhouse gases by promoting the use of biomass instead of fossil fuels. However, at this stage this observatory has not yet been established and the impact on biomass use is too speculative to quantify. We conservatively estimate the effect on emission reductions as zero.

5.2.24 WA-A01 Ecotax on non-returnable packaging

Description. In the framework of its policy of environmental taxes (ecotaxes) to discourage the use of disposable packaging and utensils, the federal government has introduced, from 1 July 2007, a tax on some types of disposable packaging (plastic bags for the transportation of goods purchased in retail stores, plastic and aluminium foils) as well as on disposable table utensils (Programme law of 27 April 2007).

Assumptions & calculation. The impact of this PAM, which only concerns a minute fraction of municipal solid waste, on greenhouse gas emissions has been considered as negligible.

5.2.25 SE-A01, SE-A02, SE-A03, SE-A07, SE-A08

Description. The federal government communicates via brochures and guides, campaigns in media and a website www.klimaat.be / www.climat.be. These communication channels are used to spread information on climate change, situation in Belgium, decisions of Federal government and concrete actions that may interest general public.
Consumers are informed on the CO_2 impact of goods through two important channels. 1) The Federal government publishes annually information on CO_2 emissions, fuel use, … of cars. 2) On the website www.energievreters.be / www.energivores.be the energy consumption and CO_2 emission of electrical appliances and other products (wars, insulation, ...) can be calculated; and a selection is given of the cleanest and most efficient models, based on a set of personal criteria. Building and renovation professionals have access to a portal, hosted by the Federal government, with useful information on legislation, premiums, ...
In January 2007, the Federal government and WWF launched the educative project “In de weer voor het klimaat”/ “Le climat, c’est nous“, designed for primary and secondary school teachers and students.
Financial support for local initiatives to increase public participation and awareness on climate change.
In 1999; Federal government created a specific policy for large cities to develop a harmonised development of cities that contribute to the economic growth of the nation.

Assumptions & calculation. Considerable federal efforts and financial means are given to raise awareness and inform people on climate change and energy savings. It is difficult to

assess the impact of these actions. The most important impact these measures will have is that they will stimulate people to invest in energy efficiency, make use of public transport and change their behaviour. Investments in energy efficiency and increased use of public transport are taken into account in the effects of other federal PAMs. Behavioural changes are more difficult to assess and although there are studies currently investigating this, no quantitative data is available yet. Conservatively, the effect of behavioural changes due to horizontal PAMs on emissions has been neglected.

5.2.26 OB-A01 Sustainable public procurement

Description. Via the website http://www.guidedesachatsdurables.be/, the Federal government recommends the purchase of products which are environmentally friendly and produced in socially accepted circumstances.

Assumptions & calculation. For most products, the information provided by the website does not focus on CO_2 emissions so the relationship with emission reductions is not clear and cannot be quantified. There are three main exceptions: 1) buying green electricity, which is included under the PAMs with EP; 2) buying certified wood products, which is included under AG-C02; and 3) buying new vehicles, which is included under OB-C07.

5.2.27 OB-A02 Optimisation of catering on the basis of sustainability criteria

Description. A pilot project to promote sustainable food at a Federal canteen is underway[30]. The aim is to encourage sustainable procurement in this sector too.

Assumptions & calculation. This pilot project is applicable on the federal canteen of the FPS Finance. It focuses on several aspects of sustainable agriculture, of which greenhouse gas emissions is only one aspect. With respect to greenhouse gas emissions, this PAM highlights the importance of food-miles. Considering that emissions from international transport cannot be accounted for in emission reduction reporting, we consider the effect of this PAM as negligible.

5.2.28 OB-A03 EMAS certification

Description. The federal government has fixed as objective that by 2007 all public services should be EMAS certified. EMAS certified entities set themselves objectives on the reduction of their energy consumption and an increasing use of bicycle and public transport for their employees. Besides, the management contracts of the SNCB group of companies foresee the establishment and implementation of an environmental policy plan.
Assumptions & calculation. The annual emission reduction is calculated using the following formula:

$$NP * (R_{heat} * EF_{heat} + R_{electricity} * EF_{electricity})$$

With:

NP	number of civil servants at Federal services with EMAS certification
R_{heat}	annual reduction in consumption heating

EF_{heat}	weighted emission factor heat
$R_{electricity}$	annual reduction in consumption electricity
$EF_{electricity}$	emission factor for electricity production, CCGT

To date, 8 public services have an EMAS certification [cfr. 31, 32, 33], representing more than 3000 employees. In the EMAS report, the focus is mainly on transport and consumption of energy, water and paper. Increased use of bicycle and public transport for travel to and from work is included under other measures (e.g. OB-C03) and therefore not included here. Water and paper consumption have only a marginal and unquantifiable effect on emission reductions. With respect to energy consumption, both electricity and heating, quantitative objectives have been proposed in some cases, which differ considerably among EMAS certified public services, from 2 to 15 %. We assume that EMAS certification induces a 5 % reduction in energy use per employee compared to baseline consumption, following the objectives proposed by several public services.

Mean values for energy consumption per full time employee are used (based on information from SenterNovem but corresponding to data from EMAS reports). Because there is a great deal of uncertainty with respect to other federal public services that may achieve EMAS certification, we only take into account the annual emission reductions from the already certified public services. This includes 3824 civil servants.

Results. The electricity consumption per civil servant was estimated to be 2891 KWh per year and gas and oil consumption for heat was 18 GJ [34]. Following the EMAS reports that are available, 93% of heating is with gas and only 7% is with oil. A 5% decrease of heating and electricity in the already certified public services would result in a cumulative 7,9 kton CO_2 emission reduction for 2008-2012.

5.2.29 OB-B01 Photovoltaic panels on roofs of federal government buildings

Description. In March 2007, the Federal government decided an objective of 1 km² of photovoltaïc panels on roofs of buildings of the public buildings. This will be achieved by 3 measures: 1) roofs will be made available for installing PV panels. 2) Installation of PV panels by government, via Fedesco (2 million €. will be invested). 3) the three companies of SNCB group have committed themselves to consider building and install renewable energy equipment (e.g. solar or wind) via partnerships.

Assumptions & calculation. The annual emission reduction is calculated using the following formula:

$$P * S * EF_{electricity}$$

With:

P	average annual electricity production (kWh/m²)
S	average installed area (m²)
$EF_{electricity}$	emission factor of a CCGT power plant (kg/kWh)

Fedesco has a concession of 10000 m² of roof area, available for installation of PV panels. Personal communication with Fedesco revealed that it is foreseen that the installation will be achieved by the end of 2010. We assume that this objective will be met end of 2010, and that there will be no increase afterwards. We assume an annual production of 100 KWh/m²

[35].The baseline emission factor is the emission factor of a CCGT power plant, which is 0,38 ton CO_2/MWh.

Results. If 10000 m² PV panels are installed in 2010, this would mean an estimated emission reduction of 0,38 kton CO_2 in 2012, and a cumulative emission reduction of 0.95 kton CO_2 for the period 2008-2012. However, we have to stress that at this moment no PV panels have been installed due to multiple problems. Through personal communication, Fedesco stated that these problems have been overcome and that installation of PV panels will start in the near future and is possible at the end of 2010.

5.2.30 OB-B02 Third party investment in energy savings in public buildings

Description. Via Fedesco, investment in work in public buildings are made and may be reimbursed based on energy savings generated (see EC-C01).

Assumptions & calculation. The activities of Fedesco are divided under PAMs EC-C01, for all investments in public buildings related to energy efficiency, and OB-B01, for all investments in public buildings related to PV panels.

5.2.31 OB-C02 Stimulation of alternative modes of transport

Description. All Federal employees benefit from free public transport, to and from work. Some federal public services have a bicycle park for employees to cover small distances. New buildings are preferentially built or bought near railway stations.

Assumptions & calculation. The annual emission reduction is calculated using the following formula:

$$NP * D * WD * [(EF_{bus} * P_{bus} + EF_{tram} * P_{tram} * EF_{metro} * P_{metro}) - EF_{car}]$$

With:

D	average distance to and from work (km)
WD	average annual work days per year
NP	increase in number of passengers with tram, bus or metro
EF	emission factor of bus, tram, metro and car (kg/gm)
P	proportion of passengers that use bus, tram or metro (%)

Employees using train to commute to work are included under measure TR-A08. Therefore we will only focus for this measure on public civil servants using other modes of public transport, *i.e.* tram, metro and bus. The average distance to and from work is based on the average distance in Brussels, 10 km [36]. We assume that most civil servants using public transport will live in Brussels. Little information was available on the percentage of civil servants using public transport. Information from PODDO showed great variability among years in the percentage of public transport (bus, tram and metro), but on average there was a 4% increase of tram, bus and metro as compared to 2005.

Results. This PAM has a minimal effect, with an annual emission reduction estimated at 0,002 kton CO_2.

5.2.32 OB-C03 Promotion of bicycle use for civil servants

Description. Mileage allowance is granted to officials who use their bicycles between home and work.

Assumptions & calculation. The effect of this PAM is completely incorporated in PAM TR-A03.

5.2.33 OB-C04 Teleworking for civil servants

Description. In a Royal Decree (November 2008) teleworking is allowed for Federal civil servants. 15 Federal civil services have introduced teleworking (situation mid 2008) and about 400 employees are involved.

Assumptions & calculation. The annual emission reduction is calculated using the following formula:

$$NT * D * DD * EF_{car}$$

With:

NT	number of teleworkers
D	average distance to and from work (km)
DD	average amount of days teleworking per year
EF_{car}	average emission factor of a car (kg/gm)

We assume that in following years the number of teleworker will not increase of decrease, although we have included the possibility to adjust this. According to the NCP, 400 civil servants were teleworking in 2008.

Teleworkers traditionally live far from work so we assume that they commute either by car (20 %) or train (80 %) and not by other public transport (i.e. bus, tram or metro) or bicycle. Following a study of Verbeke et al. [37] the average distance teleworkers commute is 51 km per day and they work at home for 77 days. Because it is difficult to quantify we assume that people that work at home do not use more energy at home, although this is probably not the case.

Results. The emission reduction achieved by this measure is estimated to be 0,47 kton CO_2 per year for the period 2008-2012.

5.2.34 OB-C07 Purchase of clean vehicles

Description. In 2004, environmental criteria were included in the purchase specifications of vehicles for Federal institutions (including Federal civil services, federal public and scientific organizations) [38]. This was put forward in a circular letter, that stipulates that 50% of vehicle fleet must be conform the environmental specifications. February 2008 a revision of the circular letter was requested.

Assumptions & calculation. An average annual distance per vehicle was estimated based on figures from FPS economy and FPS mobility, resulting in an annual distance of 21,505 km per vehicle. From the ICDO website and personal communication with PODDO, we only obtained information for 2008, with a subdivision of classes based on emission (from A to F). In 2008, 144 cars were replaced, which is 8 % of the fleet. Thus, on average a car is replaced after 12 years, which suggests no early replacements. We assume that the same number of cars is replaced every year for the period 2008-2012. Almost 70 % of cars bought in 2008 fulfilled the guidelines in the circular letter, which is higher than the 50 % proposed. We assume that 66% of the cars are diesel cars and 33% gasoline cars, based on data from FPS mobility on the registration of new cars. This information was used to estimate the average weighted emission factor of a new car for the Federal Public Services, 141,5 kg / km in 2008.
We assume that without this PAM the government would buy or lease a similar-sized car with an average emission instead of a cleaner car. Because no information was available on the size of the vehicle, only on emission factor, we set the baseline emission as the average emission of a new car, which was 144 kg/km in 2008 [39].
Because no data was available prior to 2008, we assume conservatively that there was no effect on emission reductions before 2008. For 2009 and 2010 we assume that the difference between the baseline and the actual average emission of cars will remain constant.

Results. This PAM only has a minimal effect with an estimated cumulative emission reduction of 0,09 kton for the period 2008-2012.

6 OVERVIEW OF THE RESULTS

6.1 Mean values

The emission reductions (in kt CO_2) that have been quantified are presented in Table 17, by PAM.

It should be reminded that these figures are based on assumptions, of which some relate to policy decisions that are still expected. This is in particular the case of the high impact measures Offshore wind energy and Promotion of biofuels.

Note that in this table the impact of some measures is included under another measure; this is the case of the following measures:

- TR-C02 (promoting purchase of clean cars), which is included in TR-C01 (tax reduction for clean cars);
- SE-A01 to SE-A07 (promotion and awareness raising campaigns), which are all included in measures relating to RUE and transport (e.g. EC-B01 and TR-A08);
- OB-C03 (promoting bicycle use for federal civil servants) which is included in TR-A03 (promoting bicycle use in general).

Code	Measure	2008	2009	2010	2011	2012	Total	Average
EP-A01 & EP-A05	Offshore wind energy	0	131	392	653	914	2090	418
EP-A02 & EP-A03	Tax on fossil fuels for power plants	82	82	82	82	82	410	82
EP-B01	Authorization for power plants	NE[a]	NE	NE	NE	NE	NE	NE
EC-A05	Labels on energy efficiency	NE	NE	NE	NE	NE	NE	NE
EC-B01	Tax deduction for rational use of energy (RUE)	1018	1237	1457	1677	1896	7285	1457
EC-B02	Standards for wood stoves	NE	NE	NE	NE	NE	NE	NE
EC-B03	Aid for RUE investments by non-tax payers	0,018	0,036	0,053	0,071	0,089	0,27	0,053
EC-B04	Better information on environmental impact of goods	NE	NE	NE	NE	NE	NE	NE
EC-C01 & OB-B02	RUE investments by Fedesco in public buildings	7	13	20	26	33	99	19,8
IP-A06	Tax deduction for RUE by companies	NE	NE	NE	NE	NE	NE	NE
TR-A01	Mobility plans at local level	NE	NE	NE	NE	NE	NE	NE
TR-A02	Improvement and promotion public transport	150	188	285	263	300	1186	237
TR-A03	Promoting bicycle use	5,04	5	4,96	4,89	4,82	25	4,9
TR-A04	Promoting multimodal transport of goods	16	16	16	16	16	NE	NE
TR-B01	Promoting car-pooling	0	0	0	0	0	0	0
TR-B03	Promotong tele-working	NE	NE	NE	NE	NE	NE	NE
TR-B05	Eco-driving	0	8	17	25	33	82,5	16,5
TR-C01	Tax reduction on purchase of clean vehicles	8	24	39	55	71	197	39,4
TR-D01	Promotion of biofuels	269	563	858	1405	1405	4500	900
AG-C02	Preservation and sustainable management of forests	NE	NE	NE	NE	NE	NE	NE
AG-D04	Quality standards solid biofuels	NE	NE	NE	NE	NE	NE	NE
AG-E01	Monitoring of biomass	NE	NE	NE	NE	NE	NE	NE
WA-A01	Ecotax on certain packaging	NE	NE	NE	NE	NE	NE	NE
SE-A08	Urban policy	NE	NE	NE	NE	NE	NE	NE
OB-A01	Sustainability criteria in public procurement	NE	NE	NE	NE	NE	NE	NE
OB-A02	Sustainability criteria in federal canteens	NE	NE	NE	NE	NE	NE	NE
OB-A03	EMAS certification	1,6	1,6	1,6	1,6	1,6	8	1,6
OB-B01	PV panels on public buildings	0	0	0,19	0,38	0,38	0,95	0,19
OB-C02	Promoting public transport for federal civil servants	0,36	0,36	0,36	0,36	0,36	1,8	0,36
OB-C04	Promoting bicycle use by federal civil servants	0,095	0,095	0,095	0,094	0,094	0,473	0,095
OB-C07	Tele-workiing for federal civil servants	0,006	0,013	0,019	0,025	0,032	0,095	0,019
Total		**1557**	**2269**	**3173**	**4209**	**4757**	**15886**	**3177**

NE = not estimated

6.2 Uncertainty ranges

The uncertainty on the parameters for which assumptions have been made can have a large effect on the projected emission reductions for 2008 to 2012. In Table 18 we have listed the measures for which we have assessed the impact of variability in the different assumptions. For some of them this assessment is straightforward (e.g. offshore wind energy) whereas for other measures this includes different Monte Carlo simulations (e.g. tax deduction for RUE investments in residential buildings EC-B01). We have focused on measures with a high impact on emission reductions for this uncertainty analysis.

		2008	2009	2010	2011	2012
EP-A01	Min	0	46	139	232	324
	Max	0	131	392	653	914
EP-A02	Min	82	82	82	82	82
	Max	98	110	123	136	149
EC-B01	Min	641	831	1010	1186	1361
	Max	1281	1535	1830	2162	2525
TR-A02	Min	105	129	153	175	196
	Max	235	290	344	393	440
TR-C01	Min	12	35	59	82	106
	Max	5	16	26	37	47
TR-D01	Min	240	500	800	800	800
	Max	300	600	900	1405	1405

EP-A01: based on projected installed capacity of max 846 MW and min 300 MW.
EP-A02: based on projected biomass co-combustion of min 1320 GWh or max a linear increase following the trend for 2005-2007.
EC-B01: based on different assumptions with respect to e.g. unit CO_2 emission reductions, distribution of tax deductions among different technologies and increase of number of tax deductions for 2008-2012.

Table 18. Estimated minimum and maximum emission reductions (kton CO_2) for the PAMs with the largest impact on emission reductions

7 ANNEXES

7.1 Annex 1: Relationship with the database of the National Climate Plan

In 2007, ECONOTEC, Know it! and Vito performed a study ordered by the Permanent Secretariat of the National Climate Commission, to develop and indicator database for the National Climate Plan (NCP). In line with the Cooperation Agreement of 14/12/2002, the following tasks are assigned to the Permanent Secretariat:

- develop a method to monitor and evaluate yearly the National Climate Plan;
- execute and Report the evaluation of the NCP;
- formulate adjustments/improvements to the NCP.

There was a need to have a monitoring and evaluation tool for the NCP and its reports. In the study performed in 2007, the consortium has:

- developed a central database system which can contain relevant information and makes it possible to extract reports from the information in the database (restricted online system available for all contacts involved in the NCP). Internationally, there are several reporting obligations:
    - National Communication to the UNFCCC (every 4 years)
    - Annual report to the EU (32 indicators)
    - Biannual report to the EU (projected progress report)
- developed a website for the National Climate Commission (http://www.cnc-nkc.be);
- developed a set of possible indicators for monitoring and evaluating the NCP (mainly at target and cluster level), including an inventory of the availability of data for the set of indicators.

The indicators in the previous study were 'ex post' indicators, meaning that the indicators were for evaluating and monitoring the past. Indicators were classified in 'types' and 'categories'.
The types of indicators were:

- *Follow-up indicator*: indicator allowing to measure the progress made in implementing a measure, which could be an input or an output indicator (see indicator 'categories' below),
- *Social indicator* : for example impact on employment,
- *Economic indicator*: for example impact on economic growth, value added,
- *Ecological indicator*: relate to CO_2 emissions or CO_2 emission reduction

The categories of indicators were:

- *Input indicator* : measures resources allocated for a particular measure or group of measures (budget, personnel…),
- *Output indicator* : follow-up indicator that is not an input indicator (TJ saved, MW cogeneration installed, m^2 solar panels, km bicycle paths…),
- *Outcome indicator* :impact indicator, measures progress towards reaching a particular target or cluster of the NCP (mainly CO_2-eq emission reductions),
- *Effect indicator* :indicator measuring an impact unrelated to a target of the NCP (NO_x emission reduction, air quality improvement, impact on employment…).

Typical indicators with high relevance, are the ecological indicators relating to CO_2 reductions. They may be the absolute emission level, a specific emission level (for example CO_2 per activity like number of passenger-km), or a reduction level. There are 2 types of emission reduction indicators possible:

- an emission reduction compared to a reference year like 1990;
- an emission reduction compared to a baseline-reference. For each indicator, the reference needs to be properly defined.

In the previous study, ex post ecological indicators concerning CO_2 reductions were included in the list of suggested indicators only on the level of targets and clusters of measures. They can however also be defined at the individual measure level.

In this study, the objective is to calculate the avoided CO_2 emissions for each year in the period 2008-2012, for each federal measure. In fact, this study tries to calculate the values of ex ante ecological indicators at measure level. The typology of the set of ex post indicators listed in 2007 is perfectly suitable for application to ex ante indicators. Also, the database that was developed can technically be used to fill in ex ante indicators.

For the biannual report to the European Commission ("projected progress report"), there is a request to fill in estimates of GHG emission reduction effect or sequestration effect in Gg CO_2eq per year per measure or policy for the years 2010, 2015 and 2020. The methods and values calculated in this study could be used to complement this report.

7.2 Annex 2: list of Excel files per measure

The Excel files that have been established for calculating the impact on CO_2 emissions of particular measures are the following:

EP-A01 & EP-A05	Offshore wind energy
EP-A02 & EP-A03	Tax on fossil fuels for electricity production
EP-B01	Prior authorization for power plants > 25 MW
EC-B01	Financial incentives for rational use of energy: Crystal ball calculation sheets per technology + overall calculation made with Crystal ball
EC-B03	Specific RUE aid for unprivileged people
EC-C01 & OB-B02	Energy efficiency investments in public buildings via Fedesco
IP-A06	Tax deduction for energy saving investments by companies
TR-A02	Improvement and promotion of public transport
TR-A03	Promoting bicycle use
TR-A08	Free public transport for commuters
TR-C01	Tax reduction on the purchase of clean vehicles
TR-D01	Promotion of biofuels
OB-A03	EMAS certification
OB-B01	Photovoltaic panels on roofs of federal government buildings
OB-C02	Stimulation of alternative modes of transport
OB-C03	Promotion of bicycle use for civil servants
OB-C04	Teleworking for civil servants
OB-C07	Purchase of clean vehicles

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