Report by Belgium for the assessment of projected progress

under Decision No 280/2004/EC of the European Parliament and of the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol

15 May 2009

Preliminary remark: The information in this section constitutes a complement to the template.

It is made of four parts:

1. National policies and measures.
2. Projections of greenhouse gas emissions by sources and removal by sinks.
3. Information on the use of joint implementation, the clean development mechanism and international emissions trading.
4. Questionnaire on the use of activities under Article 3.

Section 1.
National policies and measures

Reporting under Article 3(2)(a) of Decision 280/2004/EC

1. National policies and measures

1.1. General framework of the climate policy in Belgium

Introduction

Belgium is firmly committed to combating global warming. This commitment was first put into practice with the signature (1992) and ratification (1996) of the United Nations Framework Convention on Climate Change, followed by ratification of the Kyoto Protocol (2002). Bound to its European Union partners by the agreement on joint fulfilment of the Kyoto commitments (1998), Belgium intends to implement all measures necessary to ensure that it achieves its commitments under the Kyoto Protocol.

The internal burden sharing agreement (2004) between the federal and regional governments constituted an important step forward, establishing differentiated targets and a clear framework for the responsibilities of the different federated entities. Belgium's total GHG emissions (without LUCF) in 2007 were 9.9% below base year emissions, being thus below its Kyoto commitment of a -7.5% reduction.[1] At the time of the last IDR, GHG emissions in Belgium were slightly above base year levels. Belgium's GHG emissions path has thus strongly changed since 2003, which is a positive movement. Given this shift, Belgium is now on track to meet its Kyoto commitment.

Belgium moved further down the road to meeting its Kyoto target with the development of its National Allocation Plan in accordance with the European Emission Allowance Trading Directive (2003/87/EC). It constitutes a key instrument that will be used to help energy-intensive sectors improve their energy efficiency while optimising costs. Belgium has developed its second National Allocation Plan (2008-2012), which was adopted by the European Commission on 10 October 2008.

The climate policies implemented by the regional and federal authorities evolved appreciably in recent years. The structures necessary for the use of the Kyoto project-based mechanisms were put into place. The federal state and the three regions sat their objectives in the National Allocation Plans and initiated and financed Clean Development Mechanism and Joint Implementation projects. With these projects, complementing a range of policies and measures implemented by the regional and federal authorities, Belgium entered confidently into the first commitment period of the Kyoto Protocol.

In perspective of the European burden sharing agreement[2], with regard to the fulfilment of the Kyoto Protocol, the Belgian reduction objective for the emissions of greenhouse gases was set at 7.5 % below the emissions of 1990. This reduction objective must be complied with in the period 2008-2012. This means that Belgium has an average yearly Kyoto target of 134.799 Mt $CO_{2\text{-eq}}$ in the period 2008-2012.

In the Consultation Committee between the community and regional governments of 8 March 2004, a burden sharing agreement was reached between the Federal Government and the Regions on this reduction objective. Table 1 shows the amount of allowances which must be submitted on average every year during the first commitment period.

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[1] With the national burden sharing agreement, the Belgian Kyoto target was split differently between three Regions. The targets accorded to each (expressed as a percentage with respect to the reference year) are as follows: Flemish Region: -5.2%, Walloon Region: -7.5%, Brussels Capital Region: +3.475%. The Federal Government shall obtain additional allowances as a result of the use of flexible mechanisms under the Kyoto Protocol and will also take internal federal policy measures to support the reduction efforts of the Regions.

2 Council Decision 2002/358/EC of 25 April 2002 concerning the approval, on behalf of the European Community, of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments there under.

(Mton CO_2-eq.)	**1990 emissions**	**2008-2012 annual average quantity of allowances**	**corresponds to x% compared to CO_2-eq. emissions in 1990**
Flemish Region	86.987	83.463	-5.2 %
Walloon Region	54.725	50.621	-7.5 %
Brussels Capital Region	4.017	4.157	+3.475 %
Federal government	-	-2.442	-
Total BELGIUM	**145.729**	**134.799**	-7.5 %

Table 1: The national burden sharing agreement

With this national burden sharing agreement, more allowances are assigned to the three Regions than Belgium is assigned under the Kyoto Protocol. In order to compensate for the deficit (2.442 Mton CO_2-eq. per year for the period 2008-2012), it was agreed that the Federal Government shall obtain additional allowances as a result of the use of flexible mechanisms under the Kyoto Protocol.

Pursuant to this agreement, the federal Government will also take internal federal policy measures to support the reduction efforts of the Regions. The Council of Ministers of 19-20 March 2004 approved a set of measures to reduce greenhouse gas emissions. As a whole, this set of measures should guarantee a reduction in national greenhouse gas emissions of 4,8 Mt CO_2 eq. per year for the period 2008-2012, which will benefit the Regions. Within the National Climate Commission there will be each year an evaluation whether the implementation of the measures from the federal government are in accordance with the ex ante estimation. So far, no evaluation has been made yet. The agreement also provides that the Regions can determine the extent to which and the way in which they introduce flexible mechanisms in order to obtain additional allowances.

In the Belgian federal system, policies and measures to reduce greenhouse gas emissions are mapped out at different levels of responsibility based on the division of powers between the federal government and the regions. Each level of power establishes its own priorities for environment and climate policy. Coordination bodies have been set up to harmonise and create synergy between the policies implemented by the federal government and the three regions, the National Climate Commission being the most important. The general context for the preparation of climate change policies and measures is thus determined by the plans established by the federal and regional authorities setting out policy objectives and strategies. Federal and regional governments are implementing various policies and measures to achieve the national goals. A National Climate Plan for the period 2009-2012 has finally been been adopted in April 2009. In this respect, major progress has been made since the last assessment report. The plan provides a good overview of the current situation and the measures decided at different levels of power and competences.

Monitoring of PAMs

The legal basis for the obligation to evaluate the national 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 2007, the National Climate Commission launched a research study to create a national monitoring system. The database and the indicator collection are still under construction.
Belgian entities (Regions and Federal) appear to periodically evaluate the impact of their policies and measures, both ex-ante and ex-post, based on a number of methodologies. Above all, the methodology

to evaluate polices and measure should be harmonised, in order to ensure comparability and the ability to identify the most efficient measures. In this context, it is encouraging that such coordination already occurs in the context of federal and regional emission projections, based on standardised modelling assumptions. Also, work is ongoing to harmonise statistics.

FEDERAL

In 2008, the federal government has created a Task Force on climate change, made up of representatives of all federal ministers concerned. The Task force has been empowered to evaluate annually the implementation level and impact of climate policy measures from the federal government. A study has been commissioned to realise a first evaluation.

The objective of the study is to obtain the following results:

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 maximum scenario.
2. A description, for each PAM, of the hypotheses in the calculation of the avoided emission.

All federal climate PAMs will be evaluated. The basis is the National Climate Plan (NCP) adopted in April 2009, which presents the different federal PAMs as well as their relation to the 'national' measures, according to the structure of the NCP.

In the structure of the NCP, each national measure can consist of 1 or more regional measures and/or a federal measure. It is important for each federal measure considered in this project to know whether or not there exist linked regional measures.

In some cases, the impact of several measures can be estimated more precisely globally than individually. This is the case for example for the measures stimulating the development of offshore wind energy, where the impact is best measured from the installed capacity that is planned for the years 2008-2012, based on actual projects. In such cases, the relevant measures will be clustered. It should be noted that in such cases, the possible contribution of regional policies will have to be estimated and subtracted. Hence a cluster is a set of PAMs of which the impact will be evaluated jointly and which in some cases might include regional PAMs.

The end result of this task will be a list of federal PAMs, with a clear description of the possible links to relevant national and regional measures or clusters of PAMs, which need to be considered together.
On the basis of this study, the federal government will examine the evaluation on a quantitative and qualitative basis and, if necessary, explore further options by 15 October 2009 at the latest.

FLEMISH REGION

The Flemish Climate Policy Plan 2006-2012 is a strategic policy plan which serves as a guide for the period 2006-2012 for achieving the Flemish Kyoto objective, viz. the reduction of greenhouse gas emissions by an average of 5.2% compared to the emissions in 1990 for the period 2008-2012. In absolute terms this means that the average emissions during the period 2008-2012 can amount to a maximum of 82.463 Mton CO_2 -eq per year.

The plan contains actions from all the relevant Flemish areas of competence. The progress has been assessed twice in a concise climate progress report to the Flemish Government in March 2007 and November 2007. In the first half of 2009 a more in-depth evaluation report ("Progress Report 2008") was drawn up. These reports indicate the progress with regard to the execution of the plan, so as to allow the Flemish Government to respond timely with necessary adjustments or new measures if necessary. All necessary information on climate policies and measures has been collected in a new database which can be consulted online. This includes a description of the measures, their status of

implementation and information regarding indicators and costs. The database is compatible with the national database developed by the National Climate Commission.

The Flemish greenhouse gas emissions have fallen from almost 87 Mton CO_2-eq in 1990 to 80.7 Mton CO_2-eq in 2007. This means a reduction of 7.2% compared to 1990. For the first time the emissions in the Flemish Region have fallen below the Kyoto target. The descending trend which has been become clear since 2003 seems to continue.

WALLOON REGION

In Wallonia, the policies and measures regarding CO_2 emissions are part of different plans, namely the Air-Climate Plan, the Energy Efficiency Action Plan, the Renewable Energy Plan and the Plan for a Sustainable Energy Mastery. These measures are currently monitored by the respective administrations in charge.

The monitoring mainly addresses the implementation of the measures, but still lacks a quantification of the emission reductions. This quantification is under development. Provisional figures are available for many policies and measures, such as voluntary agreements, rational use of energy and renewable energy sources in the public sector, financial support for "green" vehicles or public lighting. However the methodologies applied to quantify those emissions reductions have not been officially approved yet, so these figures cannot be reported for the time being.

A working group has been set up by the end of 2008, in order to develop a single database that would allow an harmonised and co-ordinated monitoring of the policies and measures. The measures would be classified by different entries (sector targeted, GHG affected, type of instrument,…) and associated with the relevant indicators (status of implementation, expected and/or observed CO_2 reduction ,…), with multiple relationships (some measures could be associated to more than one indicator and inversely) The development of this database will start in 2009. Full compatibility with the national database developed by the National Climate Commission will be ensured.

BRUSSEL CAPITAL REGION

In Brussels, the policies and measures regarding CO_2 emissions are part of different plans, namely the Air-Climate Plan, the Energy Efficiency Action Plan. These measures are currently monitored by the administrations in charge.

The monitoring mainly addresses the implementation of the measures, but still lacks a quantification of the emission reductions. This quantification is under development for some measures (energy subsidies). However the methodologies applied to quantify those emissions reductions have not been officially approved yet.

A working group has been set up by the end of 2008, in order to develop a single database that would allow an harmonised and co-ordinated monitoring of the policies and measures. The measures would be classified by different entries (sector targeted, GHG affected, type of instrument,…) and associated with the relevant indicators (status of implementation, expected and/or observed CO_2 reduction,…), with multiple relationships (some measures could be associated to more than one indicator and inversely) The development of this database will start in 2009. Full compatibility with the national database developed by the National Climate Commission will be pursued.

In the context of the national coordination of the energy policy (the “Concere” group), a specific subgroup has been created to elaborate a common evaluation methodology of the NEEAPs in the context of the energy services directive (2006/32). Not all the measures shall be evaluated, only the most relevant ones.

Section 2.
Projections of greenhouse gas emissions by sources and removal by sinks

Reporting under Article 3(2)b of Decision No 280/2004/EC.

0. Introduction

This report accompanies the ‘Monitoring Mechanism Reporting Template version 4.2’ with the Belgian projections of greenhouse gas emissions for the period 2010–2020 following the reporting obligation as specified in Art 3(2)b of Decision 280/2004/EC. The greenhouse gas emissions are assessed for the projection years 2010, 2015 and 2020. For the reference year 2006, the latest reported emission data is reported (submission 2009).

The 2009 projections are the sum of the bottom-up projections of the three regions (Flanders, Wallonia, Brussels-Capital) which are calibrated on the regional energy balances. The bottom-up approach starts from the demand side and the consumption needs of the different sectors (industry, domestic, tertiary, transport,…) to result in sectoral energy projections. Within this approach relations between energy consumption and activity levels and energy prices are assessed at a sectoral level.

To validate the 2009 projections, the compiled regional bottom-up projections were compared with national projections calculated by the Federal Planning Bureau (FPB) based on a macro-sectoral top-down econometric model (HERMES) and on a recent study commissioned by the Belgian federal and three regional authorities based notably on the PRIMES energy model. These national modelled top-down projections are directly linked to macro-economical assumptions.

The 2009 greenhouse gas emission projections were elaborated in the course of 2008-2009 based on the most recent information available on the macro-economic context and policy implementation (see reporting template).

Descriptions of the models used for the calculation of the regional and national projections are included in annex 1 of this report (MARKAL ,EPM, TREMOVE and Environment Brussels Energy Emissions Projections Model for regional projections; HERMES and PRIMES for national projections).

1. Macro-economic context and projection parameters

1.1. INTERNATIONAL ECONOMIC ENVIRONMENT

Table 1 below gives the main assumptions regarding the international economic environment used in our projections.

Based on forecasts from international organizations, the outlook for Europe suggests that, after a slowdown in 2008 and a recession for most areas of OECD, including the Euro area, the rate of European GDP expansion should still be modest in 2010 before an acceleration in 2011 and a stabilization, in the medium term, at a rhythm close to 2.0% per year.

As far as international prices are considered, the price of crude oil is supposed to attain 62 $/barrel in 2010 (54.5 $\$_{2005}$/barrel). Afterwards, the crude oil price would increase annually by 1% in real terms, attaining a level of about 81 dollars in 2020 (61.1 $\$_{2005}$/barrel). European inflation should remain below 2% in the medium term, notably thanks to wage increases below the productivity gains. Moreover, a recovery in nominal interest rates is considered. This increase of interest rates would be in line with the inflation remaining under control.

Table 1. Main international assumptions

	2006	2010	2015	2020	2001-2010	2011-2020
EU GDP growth (% p.a.)	3.1	1.4	2.1	2.1	1.7	2.1
US GDP growth (% p.a)	2.9	1.6	2.4	2.4	1.9	2.4
Growth rate of relevant foreign markets	8.5	4.4	6.0	5.6	4.9	5.8
World imports volume growth, excluding EU	10.6	4.7	7.0	7.0	6.6	7.0
Level of oil prices (Brent, USD/barrel)	65.2	62.1	71.1	80.8	53.1	72.1
Growth of non-oil commodity prices (in USD)	1.5	2.3	1.8	1.6	2.7	1.7
Euro in USD . level x 100	125.6	124.7	124.7	124.7	120.4	124.7
. evolution (in %)	0.9	0	0	0	3.4	0.0

1.2. NATIONAL ECONOMIC ASSUMPTIONS

The main assumptions and key variables of the medium term forecast for the Belgian economy are reported in Table 2.

The top-down projections are directly linked to these macro-economic assumptions and are furthermore based on the same assumptions for external parameters such as economic growth, energy prices, population trends, degree days, etc. as used in the bottom-up approach. The bottom-up approach has no direct link with the macro-economical context.

The FPB's medium term outlook for Belgium (last update: November 2008) shows an average GDP growth of 1.6% per year during the period 2001-2010 due to the financial and economic crisis at the end of that period. GDP growth should increase to 2.1% per year on average during the 2011-2020 period. These developments can be largely accounted for by domestic demand, whereas the role of (net) exports is expected to be more limited and even (slightly) negative during the period 2001-2010. Private consumption should increase yearly by only 1.3% on average during the period 2001-2010 and by 1.9% during the period 2011-2020 mainly as a result of an acceleration of households' disposable income evolution. Gross fixed capital formation should increase by 2.8% on average per year during the period 2001-2010 and by 2.3% during the period 2011-2020.

Sectoral evolutions for the period 2001-2010 are calculated by the HERMES-model while the evolutions for the period 2011-2020 are coming from the FPB Working Paper 21-08 (and calculated with the GEM-E3 model). Market services should reach a global average growth rate of 2% during the period 2001-2010 and of 2.2% during the period 2011-2020. The average growth rate for construction should be 2.7% in the period 2001-2010 but should decrease to a growth of 1.4% during the period 2011-2020. On the other hand, several industrial branches, such as energy and consumption goods, should grow more slowly (≤1.5%).

Employment growth is expected to drop to 0.3% in 2010 and would increase to 0.6% in 2020.

Table 2. Main national economic assumptions

	year				averages	
Main national assumption	2006	2010	2015 (*)	2020 (**)	01-10	11-20
GDP growth at constant market prices (= 7+8+9)	2.8	1.5	2.1	2.0	1.6	2.1
GDP level at current market prices (bln of euros)	318.2	371.3	440.7	523.0	312.6	450.3
GDP deflator	2.0	1.8	1.3	1.6	2.2	1.4
Employment growth	1.2	0.3	0.6	0.6	0.8	0.6
Employment rate	62.4	62.8	63.7	65.1	62.4	63.9
Labour productivity growth	1.6	1.2	1.5	1.4	0.8	1.4
Unemployment rate (EUROSTAT definition)	8.3	7.6	7.6	6.6	7.7	7.4
Sources of growth: % changes at constant prices						
1. Private consumption expenditure	2.0	1.4	1.9	2.1	1.3	1.9
2. Government consumption expenditure	0.1	1.9	2.1	2.2	1.8	2.1
3. Gross fixed capital formation	4.2	1.6	2.3	2.0	2.8	2.3
4. Changes in inventories (% of GDP)	1.2	1.5	1.5	1.5	0.9	1.5
5. Exports of goods and services	2.6	3.1	4.9	4.6	2.7	4.7
6. Imports of goods and services	2.7	3.2	4.9	4.7	2.9	4.7
Contribution to real GDP growth						
7. Final domestic demand (= 1+2+3)	2.9	1.5	2.0	2.1	1.7	2.0
8. Change in inventories (=4)	0.9	0.0	0.0	0.0	0.1	0.0
9. External balance of goods and services (= 5-6)	0.0	0.0	0.1	0.0	-0.1	0.1
Growth sector activity (VA in constant basic prices)						
Industry	4.5	1.7	1.8	1.5	1.1	1.6
Energy	5.4	1.2	1.0	0.8	0.9	0.9
Manufacturing industry	3.1	1.6	1.8	1.5	0.7	1.6
-intermediary goods	3.6	2.5	1.8	1.6	0.6	1.7
-equipment goods	3.8	1.6	1.9	1.6	0.4	1.8
-consumption goods	2.1	0.5	1.5	1.3	1.0	1.4
Construction	8.5	2.2	1.5	1.4	2.7	1.4
Market services	2.7	1.6	2.3	2.1	2.0	2.2
Non-market services	0.7	1.3	1.9	1.5	1.1	1.7
Labour force						
Activity rate	72.5	72.0	73.4	74.0	71.9	73.4
Total labour force (annual var. in thousands)	52.7	13.2	26.5	29.7	33.2	28.6

(*) for sector activity: average annual growth rate over 2010-2015
(**) for sector activity: average annual growth rate over 2015-2020

1.3. EVOLUTION OF FUEL PRICES

Assumptions on the evolution of the fuel prices are presented in Table 3 below. These assumptions are based on the assumptions on the evolution of fuel prices used for the development of the 2007 PRIMES energy scenarios (for DG TREN).

Table 3. Evolution of the fuel prices

Prices			2010	2015	2020
Electricity sector	(€ $_{2005}$ / GJ)	natural gas	6.15	7.08	8.78
		hard coal 0.5 % S	2.39	2.59	2.81
		hard coal 1.5 % S	2.39	2.59	2.81
		heavy fuel oil	8.07	8.90	9.34
		waste wood Belgium	3.96	4.33	4.73
		waste wood imported	5.23	5.71	6.24
Industry	(€ $_{2005}$ / GJ)	natural gas	6.52	7.45	9.15
		heavy fuel oil	7.89	8.73	9.17
		light fuel oil	13.55	14.89	15.6
Tertiary sector	(€ $_{2005}$ / GJ)	natural gas	8.8	9.73	11.43
		light fuel oil	12.85	14.2	14.91
Residential sector	(€ $_{2005}$ / GJ)	natural gas	12.13	13.06	14.76
		light fuel oil	13.55	14.89	15.6
Transport	(€ $_{2005}$ / l)	gasoline	1.21	1.21	1.23
		gas oil - diesel	0.96	0.96	0.99

Fuel prices mentioned above were only explicitly used in the bottom-up projections to calculate energy and emission projections for the electricity sector (including CHP) and certain industry sectors. For these sectors fuel prices were used as input in the MARKAL model. For the other sectors the evolution of fuel prices was not explicitly taken into account because the applied bottom-up approaches for these sectors were not suited to use energy prices directly in their calculation methods.

1.4. DEMOGRAPHIC EVOLUTION

The demographic projections are based on the prospects 2007-2060 made by the Federal Planning Bureau and General Direction of Statistics and Economic Information in May 2008 (Planning Paper 105: Demographic Prospects 2007-2060). The prospects are based on the observations of the 1st of January 2007. (For more detail, e.g. prospects per age category, see web-site: http://statbel.fgov.be).

Prospects for the number of households, the determining variable for the energy use of households, are not included in the prospects. These data were submitted by the regions.

Table 4. Demographic evolution

Demographic assumptions	statistics	prospects		
	2006	2010	2015	2020
Population Belgium	10 511 852	10 807 396	11 199 756	11 538 332
Population Flanders	6 078 600	6 230 774	6 426 844	6 586 713
Population Wallonia	3 413 978	3 504 559	3 632 010	3 751 511
Population Brussels region	1 018 804	1 072 063	1 140 902	1 200 108
Number of households Belgium (mio)	4.473	4.74	5.045	5.342
Number of households Flanders (mio)	2.498	2.634	2.772	2.894
Number of households Wallonia (mio)	1.461	1.537	1.636	1.737
Number of households Brussels region (mio)	0.499	0.526	0.559	0.588
Average household size Belgium	2.35	2.28	2.22	2.16
Average household size Flanders	2.43	2.37	2.31	2.28
Average household size Wallonia	2.34	2.28	2.22	2.16
Average household size Brussels region	2.04	2.04	2.04	2.04

The information in Table 4 for 2006 is the national reported statistics by the National Institute for Statistics (NIS).

1.5. CO_2 PRICES

CO_2 prices are especially relevant for the choice of fuels in the electricity sector and industrial installations covered by the EU-ETS. A CO_2 price of €$_{2005}$ 20 for the year 2010 with a gradual increase to €$_{2005}$ 30 for 2020 was suggested by the EC. For the 2009 projection we assumed following evolution of CO_2 price (prices are expressed in 2005 prices):

€ $_{2005}$ / ton CO_2	2010	2015	2020
CO_2 trade price	20	23.7	30

2. Projection Assumptions

All currently implemented and adopted policies and measures taken into account in the 'with measures' scenario are presented in the reporting template .
The section below summarises the general and specific assumptions included in the 'with measures' scenario 2010-2020, developed by the regions. The national 'with measures' projections 2010-2020 are the sum of the Flemish, Walloon and Brussels projections. The electricity production sector was modelled at national level.

The regional energy related projections are based on regional energy statistics. Contrary to the federal energy statistics (EUROSTAT) which consist of sales data, the regional energy statistics are based on consumption data.
This is particularly important for the transport sector: the regional CO_2 emission projections for road transport are based on regional mobility data (vehicle kilometers, etc.) while the national top-down CO_2 emission projections for road transport are based on fuel sold.

2.1. GENERAL ASSUMPTIONS

Following general assumptions are used in the calculations of both the national top-down and regional bottom-up 2009 emission projections.

2.1.1. Emission factors

The emission factors reported in the 'Belgium's Greenhouse Gas Inventory (1990-2007) National Inventory Report' are used for the calculation of the 2009 projections.
More specifically, the emission factors for the energy related CO_2 projections (CRF Cat 1A Fuel Combustion Activities) are represented in Table 5 below. The emission factors for cokes oven gas, refinery gas and blast furnace gas are adjusted values based on inquiries with the sector, in contrary to the other factors which are IPCC default values.

Table 5. Emission factors used for the energy related CO_2 emission projections

(kton CO_2/PJ)	Flanders / Wallonia / Brussels
Hard coal	92.7
Cokes	106.0
Brown coal, lignite	99.2
Other solids (wastes,...)	variable
Natural gas	55.8
Cokes oven gas	38.0-40.0
Blast furnace gas	250.0-265.0 (Flanders) 256.8-264.3 (Wallonia)
Refinery gas	55.1-56.5
Heavy fuel oil	76.6
Petroleum cokes	99.8
Light fuel oil, gas oil	73.3
Gasoline	68.6
LPG	62.4
Other fuels	72.6

2.1.2. Global Warming Potential

CO_2 equivalent emission projections 2010-2020 are calculated using the Global Warming Potential (GWP) values specified in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.
For the main greenhouse gasses these are more specifically:

Table 6. Global warming potential

Greenhouse Gas	GWP
CO_2	1
CH_4	21
N_2O	310

2.1.3. Climate assumptions

The regional and national top-down energy and CO_2 projections for the residential, tertiary and green house sector were calculated based on the assumption that the number of degree-days for the period 2010-2020 is equal to the average of the period 1993-2003, and remaining constant for the whole projected period. This average amounts to 1900 degree-days (reference 15/15) (or 2314 degree-days at reference 16.5/16.5) and characterizes a mild climate. For the reference year 2006 the CO_2 data refer to the actual reported number of degree-days (1794).

2.2. SECTOR SPECIFIC ASSUMPTIONS

Following sector specific assumptions are used in the calculations of the regional bottom-up 2009 emission projections.

2.2.1. Assumptions for the electricity production sector

The 2009 emission projections for the electricity production sector are modelled with MARKAL at national level.

The 2009 projections for the electricity production take into account:

- assumptions on the evolution of energy and CO_2 prices as explained in chapter 1 above;
- assumptions (calculations) on the evolution of the electricity demand (in some sectors);
- assumptions on the evolution of the electricity production park;
- assumptions on the import of electricity

Table 7 shows the demand and supply data on the electricity sector for Belgium (TWh).
Demand data below do not include own use of electricity production plants and distribution losses and represent net data. Own use is considered indirectly through using lower net efficiencies of electricity plants in model calculations.

Table 7. Electricity demand and supply for Belgium

TWh	2006	2010	2015	2020
Demand*	85.048	84.547	89.256	93.176
Net import (balance export – import)	10.157	7.094	7.001	5.995
Production	84.787	87.280	92.312	97.269
Use for pumping and distribution losses	9.895	9.827	10.056	10.048

* Total demand (demand + use for pumping + distribution losses) = total supply (net import + production)

Above assumptions show an annual increase of the electricity demand between 2006 and 2020 with 0.6 - 0.7% .

The trans-boundary electricity trading is considered exogenous in the modelling of the electricity production. The net import of electricity was 6.3 TWh in 2005 and 6.8 TWh in 2007. The year 2006 was an exceptional year and the import ran up to 10.16 TWh.

The Belgian projections uses the import levels used in the PRIMES baseline. It is assumed that the import level for the years 2010 and 2015 is only slightly higher than the import level of 2005. The import level in 2020 is assumed to be slightly less than the level in 2005.

The actual evolution of the net-import will mainly depend on new trans-boundary transport capacities and the location for new production plants.

The with measures scenario integrates the Belgian Law on the progressive phase-out of nuclear energy. It thus takes the decommissioning of nuclear power plants once they turn 40 into account, conform the Law on the progressive phase-out of nuclear energy for industrial electricity production which has been consented by the federal government on January 31, 2003. In this scenario, the decommissioned nuclear plants are mostly replaced by new CCGT-power plants.

Table 8 shows the shares of nuclear, fossil fuel and renewables in total domestic electricity production. In the MARKAL model electricity is produced at minimal costs. The base demand (base load) is in large part met by nuclear plants, CHP installations and renewable energy (wind). Table 9 shows the share of CHP in total domestic electricity production.

Table 8. Share of nuclear, fossil fuel and renewable in total domestic electricity production.

Shares in total domestic electricity production (%)	2006	2010	2015	2020
Share of gas	31.7	31.5	39.4	42.2
Share of oil	0.6	0.9	1.1	1.5
Share of coal	8.5	6.1	12.5	12.8
Share of nuclear	55.1	53.5	38.6	32.8
Share of renewable, including biomass	3.1	6.8	7.2	9.5
Share of waste (non renewable fraction)	1.0	1.4	1.3	1.2

Table 9. The share of CHP in the total domestic electricity production.

Share in total domestic electricity production (%)	2006	2010	2015	2020
Share of CHP (including CCGT with heat production)	11.7	15.9	17.5	16.8

The share of renewable in the total domestic electricity production runs up to 6.8 % in 2010 and 9.5 % in 2020 (corresponding to 7.0% and 9.9 % of total electricity supply). This share of 6.8 % in 2010 meets the indicative target of 6 % in 2010 set by the European Directive 2001/77/EC. The policy and measures to support and promote renewable energy in the three regions are described in Section 1 of this report.

The share of gas in the total domestic electricity production runs up from 31 % in 2006 to 43.6 % in 2020, while the share of nuclear declines from 55 % to 34 %. This increase of the share of gas is the result of the electricity demand increase (+24% between 2000 and 2020) and of the partial closure of the first nuclear plants.The closed nuclear plants are for most part replaced by combined cycle gas turbines.

The calculation of the CH_4 and N_2O emissions of the electricity production sector are based on applying the CH_4 and N_2O emission factors on the final energy carriers. Unlike for the projections of CO_2 emissions, wood and other biomass burning is taken into account for the projections of CH_4 emissions.

For the CO_2 emission projections originating from waste incineration each region applies its own methodology as specified in the NIR. The CO_2 emissions from waste incineration with energy recuperation are reported in the energy sector as 'other fuels'. For the Flemish region part of the CO_2 emissions origination from flaring activities are allocated to the energy sector while for the Walloon region these emissions are allocated to the waste sector.

2.2.2. Assumptions for the conversion sector

Refineries

Refining is an activity that only takes place in the Flemish region. The emission projections assume that the capacity of the refineries in Belgium will not increase after 2010. However, refinery activities are affected by the economic recession. Overall, energy consumptions drops by 11 % between 2006 and 2010. This is a combined result of an activities slowdown, increased use of CHP and energy efficiency improvements. After 2010 improved energy efficiency improvements in end use sectors will affect activities and energy efficiency improvements will continue to affect energy consumption in refineries sector.

The N_2O and CH_4 emission projections from refining activities are estimated by applying emission factors to the final energy carriers. The CH_4 emissions have a diffuse character and include the flaring emission projections for the Flemish region.

Cokes production

Table 10. Cokes production in the Flemish and Walloon Regions (Mton).

Cokes production (Mton)	2006	2010	2015	2020
Flanders	1.250	1.250	1.500	1.500
Wallonia	1.360	0.720	0.720	0.720

Flanders

In Flanders the scenario assumes one cokes production plant in steel industry operating at maximum capacity, and equipped with a desulphurisation unit. In 2015 the capacity of this plant will increase by 20%

Wallonia

Up to 2007, two coke factories were operating in Wallonia of which only one remains afterwards. New capacities are not likely to be built, but the current installation is assumed to be kept in operation as long as possible. No change in energy use is envisaged.

2.2.3. Assumptions for the fugitive emissions of fuels

Flanders

Projections of fugitive CH_4 emissions from the distribution of natural gas in Flanders are calculated based on assumptions on the evolution of the natural gas network and the gradual replacement of pig iron pipes by PE, PVC or steel by 2010. The expansion of the natural gas network in Flanders is estimated taking into account the increase of the number of households and the intention of the Flemish government (Flemish coalition agreement of July 2004 and policy document 2004 - 2009 of Flemish minister for Energy) to provide 95% of the houses in residential areas with the possibility to connect to the natural gas distribution grid (the possibility for new and existing dwellings to connect to the natural gas distribution grid was 83.6% in 2008). The 95% target is assumed to be reached in 2012 and to remain constant after that.

Wallonia

Calculation of CH_4 emissions from the distribution of natural gas in Wallonia are based on the assumption that the natural gas network in Wallonia will expand linearly until 2020. Pig iron pipes and asbestos cement pipes will continue to be replaced and all new distribution pipes are of steel or PE/PVC.

Brussels region

CH_4 emissions from the distribution of natural gas in the Brussels region are calculated assuming that all pig iron pipes of the network are replaced by polymers (PE /PVC) by 2015. Furthermore it is assumed that the network does not experience further expansion.

2.2.4. Assumptions for the industry

Projections of energy use in the industry sector are based on assumptions of activities and energy intensity (amount of energy used per unit of activity).
Table 11 and 12 present the basic assumptions taken into account to establish the industrial CO_2-emissions projections for each region. It lists for each major industrial sector the assumed activity growth rates between 2006 and 2010 and between 2010 and 2020. The annual energy efficiency improvements and global energy changes between 2006 and 2010 are provided.

CO_2 emission in the industrial sector in Flanders

The **larger companies** (representing 85 % of the total fuel use in industry) are modelled with MARKAL at installation level. For these companies detailed information was available for the period

2006-2012. For the period 2012-2020 CO_2 emissions from these companies are mainly driven by the EU Emission Trading System, assuming a European allowance price of € 30 in 2020.

Specifically for the steel industry, the projections foresee a third blast furnace to be operational after 2010. This is reflected in the annual growth rate of 2.8% for the period 2010 - 2020.

For the **smaller companies** (representing 85 % of the total fuel use in industry) assumptions are made at sector level.

Following assumptions on activity and energy efficiency improvements are taken into account:

Table 11. Activity and energy intensity assumptions for the industrial sector in Flanders

Sector	2006 - 2010			2010 - 2020
	annual growth rate of activity (%)	annual energy efficiency improvement (%)	annual increase of energy use (%)	annual growth rate of activity (%)
O2 Steel production	-1.6	-0.05	-1.1	2.8
Non ferrous metals	-2.6	3.4	-6.0	0.5
Chemistry	-1.0	0.5	-1.5	1.5
Ceramic, glass	-1.0	1.3	-2.3	1.6
Paper	1.0	0.6	-0.4	2.0
Food and drinks	-0.3	3.5	-3.8	1.9
Metal processing	0.2	2.9	-3.1	1.7
Textiles	-0.7	1.5	-2.3	1.5
Other industries	-0.8	3.3	-4.1	1.2

CO_2 emissions in the industrial sector in Wallonia

Table 12 presents basic assumptions taken to establish emissions projections. It lists for each major industrial sector the assumed activity growth rates between 2006 and 2010 and between 2010 and 2020. It also provides annual energy efficiency improvements and calculates global energy changes between 2006 and 2010.

Table 12. Activity and energy intensity assumptions for the industrial sector in Wallonia

sector	2006 - 2010			2010 - 2020
	annual growth rate of activity (%)	annual energy efficiency improvement (%)	annual increase of energy use (%)	annual growth rate of activity (%)
Iron production	10.4	0	10.4	0.0
O2 steel production	10.2	0	10.2	0.0
Electric steel prod.	3.1	-0.6	2.3	2.2
Steel transformation	1.6	-0.6	-1.2	2.2
Steel foundries	1.5	-0.9	-0.6	0.1
Non ferrous metals	0.6	-1.2	-0.6	0.8
Cement	0.0	-0.9	-0.9	2.5
Lime	0.4	-0.2	0.5	1.0
Flat glass	4.5	-1.2	1.9	2.0
Container glass	0.6	-1.2	2.1	0.0
Glass fibres	5.0	-1.2	1.2	2.5
Other non metallic minerals	2.0	-0.5	1.5	1.5
Paper pulp	-3.6	-3.9	-7.36	1.8
Paper	-2.2	-3.9	-6.01	1.8
Basic chemistry (*)	1.8	-1.7	0.1	2.1
Chemical specialities	2.5	-1.7	0.8	3.2
Food and drinks (**)	1.6	-0.9	0.7	1.5
Metal processing	0.7	-1.4	-0.7	1.8
Textiles	0.0	-0.5	-0.5	-0.4
Other industries	1.6	-0.5	1.1	1.7

(*) : order of magnitude
(**) : except sugar and milk

Large energy consumers are modelled at installation level. This includes major iron and steel installations, clinker and lime kilns and flat glass ovens.

Between 2006 and 2010[1], rates of change of activities are based on estimates of market growths or perspectives of industrial sectors, including CO_2 allocation claims in the emission trading scheme, investment projects and equipment closures that are announced.

Resulting rates are listed in the preceding table. After 2010, large installations are assumed to be maintained in activity. Expected structural changes are taken into account when known.

Other activities are assumed to follow for value added trends of those sectors as identified by the European study "Energy and Transport Trends 2030 – update 2007".

All major industries are involved in branch agreements whereby they are committed to improve their energy/CO_2 efficiency by 2010/2012. We therefore apply gradually, at sector level, specific energy consumption improvements as stated in those agreements up to 2010.

Branch agreements are implemented until 2012. There is a fair chance that new agreements will be launched for the period 2012-2020, however no decision has yet been formally taken and conditions

[1] 2010 is considered as a mean year representative for the period 2008-2010.

and energy efficiency improvement objectives are not yet determined. We therefore assume here that an overall further 1% efficiency improvement per year may be achieved between 2010 and 2020[2].

For the large energy consumers, the following assumptions are made.

Iron and steel production

Projections are very different from previous communications, because the sector industrial policy has significantly changed recently. Indeed, two blast furnaces were due for closing between 2005 and 2010. They are now maintained in activity, together with upstream and downstream capacities (i.e. sinter plant, O2 steel factory and hot rolling mill). Projections are now established assuming they remain in activity up to 2020.

As one of the furnaces was indeed stopped in 2005 but restarted in 2008, large emission increases therefore occur in the perspectives between the base year 2006 and 2010.

The present scenario may be considered as a high level scenario. Indeed the present low economic contingency yields the temporary closure of most installations of the integrated steel factories. Currently, in the Walloon region, 2 out of 3 blast furnaces have been stopped by November 2008 and the remaining one stopped at the beginning of April 2009. Such a situation had incidence on the operation of sinter plants, O_2 converters and hot rolling mills. Assuming all installations are operating again by August 2009, one may estimate that the impact on CO_2 emissions would correspond to yearly outputs of some 40% of nominal capacities for 2009.

Considering the year 2010 as representative of a mean year on the Kyoto commitment period (2008-2012), this situation would imply emissions reductions of 720 Gg with respect to the baseline scenario for 2010.

Iron and steel transformation

See table 12 above.

Clinker kilns

Cement consumption per head in Belgium is among the highest figures of Europe. Cement production is therefore not likely to increase much. Import threats existed a few years ago, the sector is now in a better situation to resist.

Clinker production is more or less stabilized, but capacity is expected to slightly increase after 2010.

Lime production

Market restrictions due to the reduction in steel production are to be compensated with the opening of new markets such as environment protection or paper production and transformation. Production may experience a moderate growth.

No major structural change in equipments is envisaged

Glass production

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[2] Globally, current agreements should yield a 1% per year energy efficiency improvement in the Walloon industry on the period 2000-2010/2012. We here simply assume the trend to continue until 2020.

We assume a continuous increase of flat glass demand of 2 % per year, a trend currently observed on the European market, generating the opening of a new float every year in Europe.

The evolution of container glass production is explained by the fact that a major actor closed down and only a part of its production equipment was put back into operation. The sub-sector is thus slowly and partially recovering lately, but prospects are very difficult to establish.

Glass fibres usually experience sustained growth, though it has slowed down lately.

Evolution of fuel mix

Globally, the share of natural gas in the fuel mix is assumed to increase, and it is taken into account by affecting net increases of fuel consumptions to natural gas. This assumption is not considered in iron and steel, cement and lime productions where low or moderate quantities of natural gas are used. It is not considered either in sectors where the total growth of activity between 2000 and 2020 is less than 10%, as we assume a minimum specific energy consumption improvement of 0.5% per year.

In the particular case of iron and steel production, fuel mix changes are primarily led by the need to eliminate all produced coke oven and blast furnace gases, while consumption capacities in the electricity sector are limited.

Brussels region

Industry represents in 2006 only 3.4% of final energy consumptions in the Brussels Capital Region. In such an urban area, perspectives of development of industrial activities are low. Indeed, energy consumptions of the sector have remained nearly constant since the early 90's. We assume here that they remain constant until 2020.

Process emissions of CO_2 and non energetic use of fuels in Flanders and Wallonia

Main non-energetic uses of fuels in Flanders:

- natural gas for ammonia production (carbon converted to CO_2 emissions);
- natural gas for processes where the carbon is fixed in the end-products;
- natural gas for the production of hydrogen and ethylene oxide
- naphtha and LPG in crackers and in other (carbon fixed in end-products);
- heavy fuel oil for production of carbon black; use of coal-tar in one company

Because it concerns non-energetic use of fuel it is assumed that climate policy will not have an effect on the uses of above fuels. In addition there are also several processes with chemical reactions, in which carbonaceous products, generally not considered as fuel, are oxidised to CO_2. Such process emissions occur in the chemical industry (production of ethylene oxide, acryl acid, cyclohexanon, synthetic soda), in refineries, in the sector of non metallic minerals, and during flaring and the desulphurisation of flue gasses.

Main non-energetic uses of fuels in Wallonia:

- coal in the iron and steel industry and selected applications of engineering (metallic works);
- petroleum products in several sectors, notably in chemistry and cement;
- natural gas for ammonia production (carbon converted to CO_2 emissions)

Projections of CO_2 process emissions are linked to growth rates of activity (see tables above).

CH_4 and N_2O emissions in the industrial sector in Flanders and Wallonia

The 2009 CH_4 and N_2O emission projections for the industrial sector are made using the emission inventory methodology reported in the NIR.

CH_4 emissions in the industrial sector in Flanders and Wallonia originate from the iron and steel sector (sinter production). The same activity growth trend as mentioned in table 11 and 12 above are assumed. The emission levels are directly linked with this same growth trend.

The N_2O emission originates from caprolactam and nitric acid production. Projections are based on information from the concerned companies regarding activity data and implementation of reduction measures.

F-gas emissions in the industrial sector in Flanders and Wallonia

The F-gas emission projections drawn up from the model developed by ECONOTEC Consultants and the VITO in the context of a study ordered by the Federal Department of the Environment[3] in 2004 have been revised and adjusted based on recent historical trends.

2.2.5. Assumptions for the residential sector

The climate regulations and measures considered for the 2009 'with measures' projections are presented in the reporting template section 'Policies & Measures'. The assumed evolution of the population and the number of households is discussed in section 1.4 above. Estimates are made on the number of new dwellings. Distinction is made between new and existing houses.

Flanders

Heating and equipment

As of 2010 it is assumed that the heat demand of all new single-family dwellings and apartments respect an E-level of 80 following the implementation of the EC directive on energy performance of buildings.

For existing dwellings, projected fuel consumption is determined by:

- The average fuel consumption in a existing dwelling in 2007;
- The impact of "rational use of energy" policies as presented in the reporting template section 'Policies & Measures'

By 2020, the fuel consumption of existing houses is reduced by 12% compared to 2000 values.

[3] ECONOTEC Consultants and VITO 2004, Preparation of a federal policy for the reduction of greenhouse gas emissions (HFCs, PFCs and SF6).

Fuel mix

The share of natural gas in fuel consumption reaches 50% in 2020 (versus 43% in 2006) while light fuel would still represent 43% of consumption (versus 48% in 2006).

Wallonia

Heating

In the residential sector, the heat demand of all new dwellings, from 2008 on, are assumed to respect a K45 standard, as a result of the implementation of the EC directive on energy performance of buildings. They are also assumed to be equipped with up to date performing heating systems. Consequently, their specific energy consumption for heating improves with more than 20% when compared with current new buildings.

For existing dwellings, fuel consumption is influenced by two factors:

- the further penetration of central heating, which tends to increase global consumption;
- various energy use improvements tending to decrease energy consumption, such as:
  - by 2020, substitution at 90% of single glazing by high efficient double glazing (the remaining 10% are supposed to be technically difficult or too costly for low income owners);
  - roof insulation;
  - progressive replacement of boilers by high efficient or condensing units;
  - improvement of regulation.

By 2020, the specific heat demand of existing houses is reduced by 12% with respect to 2000 values and that of apartments by 9%.

Equipment

By 2020, sanitary hot water preparation requires increased energy consumption due to the growth of the number of dwellings equipped with sanitary hot water units. However, the average use by dwelling decreases by 10% between 2000 and 2020, because equipment improves (essentially centralized units). No increase of water consumption per dwelling is considered, assuming increases would be balanced by the reduction in household size.
Concerning specific electricity uses, it is assumed that by 2020, all equipment present specific consumptions comparable to those of the best available units currently proposed on the market.

Fuel mix

The share of natural gas in fuel consumptions continues to grow, reaching 40% by 2020, while light fuel would still represent 52% of consumptions. Others are coal, reduced to 1%, and wood (7%).

Brussels region

Heating

In the residential sector, the heat demand of all new dwellings, from 2008 on, are assumed to respect an E90 standard, as a result of the implementation of the EC directive on energy performance of buildings. They are also assumed to be equipped with up to date performing heating systems. Consequently, their specific energy consumption for heating improves with more than 20% when compared with current new buildings.

For existing dwellings, fuel consumption is influenced by two factors:

- the further penetration of central heating, which tends to increase global consumptions;
- various energy use improvements tending to decrease energy consumptions such as:
    - substitution of single glazing by high efficient double glazing;
    - roof insulation;
    - progressive replacement of boilers by high efficient or condensing units;
    - improvement of regulation

By 2020, the specific heat demand of houses is reduced by 11% with respect to 2006 values and that of apartments by 15.5%.

Equipment

By 2020, sanitary hot water preparation requires increased energy consumptions due to the growth of the number of dwellings equipped with sanitary hot water units. However, the average yield of centralized installations, increases by 5% between 2006 and 2020, because equipment improves (essentially centralized units). No increase of water consumption per dwelling is considered.
Concerning specific electricity uses, it is assumed that by 2020, all equipment present specific consumptions comparable to those of the best available units currently proposed on the market.

Fuel mix

The share of natural gas in energy consumptions continues to grow, reaching 75% by 2020 (vs. 68% in 2006), while light fuel would still represent 21% of consumptions (before CHP heat is deduced).

2.2.6. Assumptions for the tertiary sector

<u>Flanders</u>

Energy projections are based on the autonomous evolution of activity (based on added value) of the different sub sectors and the implementation of energy saving measures. The energy use projections for buildings consider final energy savings of 1% per year for the period 2006-2020, according to the Energy Service Directive.
The share of fuels is assumed to remain the same over the projection period (75% natural gas and 23% light fuel). CHP is assumed to develop in the tertiary sector.

<u>Wallonia</u>

In the tertiary sector, the growth of the building stock (assumed to be 0.5%/year) tends to increase fuel consumptions, while improvements (due notably to the enforcement of the European directive on the energy performance of buildings) tend to reduce them. Considering that the building stock renewal is faster than in the residential sector and that renovations are more thorough, specific fuel consumption is assumed to decrease by 1%/year between 2006 and 2010 and by 1.2%/year after 2010.
Electricity consumption is increasing due to the building stock increase and by the introduction of new electricity uses. This growth is partly compensated by the improvement of equipment (lighting, engines, stand-by consumption). New usage is assumed to increase electricity consumption by 1.25%/year through the period considered.

By 2020, the share of natural gas in fuel consumptions grows to 53%, while light fuel represents 43%.

<u>Brussels region</u>

For the tertiary sector, the growth rate of the building stock, supposed to follow the employment expected growth, is decreasing between 2006 and 2011, increasing between 2011 and 2016, and stabilizing at 0.55%/year from 2016. It tends to increase fuel consumption, while improvements (due notably to the enforcement of the European directive on the energy performance of buildings) tend to reduce them. Despite the fact that the tertiary building stock renewal is faster than the residential one, specific fuel consumption is assumed to increase by 0.8%/year between 2006 and 2020 in average.

Electricity consumption is increasing due to the building stock increase and the introduction of new electricity uses. This growth is partly compensated by the improvement of equipment (lighting, engines, stand-by consumption). New usage is assumed to increase electricity consumption by 1.8%/year between 2006 and 2020.

By 2020, the share of fuels in energy consumption decreases to 49% (vs. 52% in 2006): light fuel represents 13% of the energy consumption and natural gas 36%.

2.2.7. Assumptions for the agricultural sector

Greenhouse gas emissions in the agricultural sector mainly consist of CH_4 and N_2O emissions originating from animal husbandry and emissions from agricultural soils.

Following animal numbers were used in the 2009 projections:

Table 13. Animal numbers used in the projections

Animal numbers (thousands)	2010	2015	2020
Dairy Cattle	488	617	586
Non-dairy Cattle	1.949	1.782	1.815
Sheep	229	229	229
Horses, Mules and Asses, Goat, Other	63	63	63
Swine	6.551	6.810	6.728
Poultry	33.959	35.584	36.584

Flanders

CO_2 emissions originating from energy use in the agricultural sector originate from the greenhouse sub sector (65%), non stationary sources (fisheries, tractors,.. 20%) and the warming of stables (15%).
Main assumptions for the 2009 'with measures' energy related projections for the agricultural sector are listed in Table 14 below. Furthermore it is assumed that the electricity use remains constant up to 2020.

Table 14. Annual energy use increase in the agricultural sector

Sector		Annual increase of energy use (%) in period 2006 and 2020
Intensive animal husbandry	(stationary sources)	-0.50
Green house sector	(stationary sources)	-0.86 (compared to 2004)
Arable cultivation	(mobile sources)	0 % (2000 - 2012) and -0.5 % (2013 – 2020)
Animal husbandry	(mobile sources)	-0.50
Horticulture	(mobile sources)	0.00
Permanent cultivation	(mobile sources)	0.00
Fisheries	(mobile sources)	-0.80

The 2009 'with measures' CH_4 and N_2O emission projections take all policy measures, listed in the reporting template, section 'Policies & Measures', into account and new assumptions on the evolution of the animal herd: a general decrease of the cattle herd except for the number of dairy cattle between 2010 and 2015 (increase due to abolition of milk quotum in 2015), stabilisation of the number of poultry and swine due to new regulation on investment support subject to manure management.

Wallonia

Energy related emissions, including the emissions from the gas-oil of tractors and other mobile equipment, in the agricultural sector in the Walloon region are negligible (< 1 PJ).
CH_4 and N_2O emission projections take into account the evolution of livestock (all animal categories) and type of cultivation in Wallonia that has been revised with the agriculture department in charge of agricultural economy analysis.

Brussels region

No agricultural activities take place in the Brussels region.

2.2.8. Assumptions for the transport sector

Flanders

CO_2, CH_4 and N_2O projections for Flanders are calculated based on a bottom-up approach taking into account the number of kilometres driven on road or rail or travelled on inland waterways.

Road transport

Mobility

Based on two mobility scenarios which were developed in the framework of the strategic EIA study on mobility for Flanders (a BAU scenario and a SD scenario) we assume that the number of vehicle kilometres will increase to 56.7 billion in 2010. For the period 2010 - 2020 projections are based on recent trends, resulting in a projection of 60 billion vehicle kilometres in 2020.

Vehicle fleet

The vehicle fleet depends on the supply and the sales of new vehicles and the use of older vehicles. Following assumptions on the distribution of new vehicles are used:

Table 15. Assumptions on the distribution of new vehicles

Vehicles	Fuel	2010	2015	2020
Cars	Diesel	75%	74%	70%
	Gasoline	24%	21%	15%
	Hybrid (diesel, gasoline, CNG, H_2)	0.5%	4.75%	14.75%
	Other (LPG, CNG, electrical, H_2)	0.5%	0.25%	0.25%
Light duty vehicles	Diesel	96.9%	94.4%	81.9%
	Gasoline	2.7%	2.7%	2.7%
	Hybrid (diesel, gasoline, CNG, H_2)	0%	2.5%	15%
	Other (LPG, CNG, electrical, H_2)	0.4%	0.4%	0.4%
Heavy duty vehicles ≤ 16 ton	Diesel	100%	100%	93%
	Hybrid diesel	0%	0%	7%
Heavy duty vehicles > 16 ton	Diesel	100%	100%	100%
Busses	Diesel	96%	86%	73%
	Gasoline	0%	0%	0%
	Hybrid (diesel, gasoline, CNG, H_2)	2%	10%	20%
	Other (LPG, CNG, electrical, H_2)	2%	4%	5%

(coaches: all on diesel in the future)

Further assumptions on sub-categories of vehicle fleet and motorcycle fleet, on average vehicle lifetimes and on the number of covered kilometres per category are also taken into account.

Measures

The ‘with measures’ CO_2 projections take the EU strategy to reduce the CO_2 emissions from new passenger cars and the introduction of bio-fuels into account. Considering the reduction of CO_2 emissions by new car models we assume that the targets (of the ACEA agreement) are not yet fully met in practice in 2008-2009. The share of bio-fuels is supposed to represent 4 % by 2010, 8 % by 2015 and 10 % by 2020.

Rail transport

Assumptions on the evolution of railway traffic are based on historical data from the national railway company. For the evolution of the railway traffic up to 2010 again the scenarios of the EIA study on mobility were used (see above). For 2010 we assume 18.7 billion gross ton-kilometres for passenger transport (+ 55% compared to 1998) and 10.8 billion gross ton-kilometres for freight transport (+ 18.5 % compared to 1998).
For the period 2010 - 2020 projections are based on the trends of the historical years, resulting in a projection of 19 billion gross ton-kilometres for passenger transport in 2020 and a projection of 11 billion gross ton-kilometres for freight transport in 2020.

The same assumptions for bio-fuels are made as for road transport.

Electrification is assumed to increase to 83% for freight transport and 96% for passenger transport in 2010.

Inland vessels

Based on historical data (traffic data for energy statistics) and the EIA study on mobility 8.5 billion ton-kilometres in 2010 and 9.7 billion ton-kilometres in 2020 are assumed. In accordance with the evolution of the fleet the specific energy consumption is assumed to amount to 10.5 l/1000 ton-km in 2010 and to 10.4 l/1000 ton-km in 2020.

The same assumptions for bio-fuels are made as for road transport.

Wallonia

Road transport

A desaggregated model of the road transport emission perspectives has not been applied. Instead, projections are established in line with prospectives published for Belgium in “European Energy and Transport – Trends 2030, Update 2007”.

Rail transport

GHG emissions from rail transport are essentially due to the transport of goods. In absence of a dedicated policy, this kind of transport experiences a regular decline. Indeed, gas-oil consumption in Wallonia has been reduced during recent years.

We assume here the continuation of the observed trend up to 2020.

Inland vessels

Transport by ships on inland waters has experienced a fast growth, due to the application of a specific policy to support this kind of transport and encourage modal shifts (subsidies for infrastructures, fiscal measures, large public works…).
Mobility has grown by 2.5% per year during 2000 and 2005. Growth is expected to remain, taking benefit from recent and future planned public investments. However, the tendency may meet a saturation effect, as most products transported on water are crude heavy primary matters, used by industries such as cement or steel productions, which are not expected to experience fast growth.

To take into account the potential benefit from recent public investments, we assume that the present trend is maintained until 2010, to be reduced by half between 2010 and 2015 and to a growth of 1% per year after 2015.

We consider separately this kind of transport. In our calculations, growth in waterways transport does not affect road transport. This approach is therefore somehow conservative.

Brussels region

Road transport

Transport growth

Projections until 2020 are issued from the TREMOVE model. This European model takes into account the evolution of the GDP, population growth, and transport infrastructures evolution. The demand for each specific mode is defined and a projected fleet composition is also used.

Mobility is then assumed to rise from 3.19 billion vehicle kilometres in 2006 to 3.38 by 2010 and 3.76 by 2020. This scenario is considered as a rather conservative approach.

Vehicle fleet

Assumptions on the evolution of the vehicle stock are in line with recent national estimates performed by TML (2006) for FEBIAC and the federal services for mobility. By 2010, diesel cars represent 72% of the stock. Conventional gasoline cars constitute 24% and hybrids appear with 4% of the stock.

Hybrid diesel cars are assumed to appear after 2010, thus by 2020, hybrid cars (gasoline and diesel) represent 31% of the stock. Though TML considers a certain penetration of compressed natural gas vehicles, we consider here that such a penetration needs further strategic decisions still to be taken (notably for the organisation of a fuel distribution network), and therefore, we do not consider CNG cars in the framework of the present reference scenario.

Fuel consumption parameters

In general cars fuel consumption is assumed to improve. Indeed, several parameters are taken into account:

- progressive introduction of hybrid vehicle;
- voluntary agreements (and future European obligations) between manufacturers and the EC in CO_2 emissions for new sold cars. In this agreement, manufacturers will reduce specific CO2

emissions of new sold cars to 140 g/km in 2009. For the years after 2010 also the penetration of hybrid and CNG cars cause a decrease in specific emissions.

Bio-fuels are supposed to represent 4 % of gasoline and gas-oil sold by 2010, 8 % by 2015 and 10 % by 2020.
It is well known that the introduction of bio-fuels has a positive effect on total CO_2 emissions (exhaust + life cycle).

2.2.9. Assumptions for the 'solvent and other product use' sector

Only the use of N_2O as anaesthetic is included in this category.

N_2O emissions from this use in Flanders and Wallonia are kept constant at current emission levels.
For the Brussels region the use of anaesthesia is supposed to follow the trend observed between 2000 and 2006.

2.2.10. Assumptions for the waste sector

Flanders

Projections of CH_4 emissions from the solid waste disposal on land in Flanders are calculated on the basis of information in the planning paper 'Uitvoeringsplan Milieuverantwoord beheer van huishoudelijke afvalstoffen (januari 2008)' of the Flemish institute responsible for waste management (OVAM). The paper considers projections up to 2015. After 2015 the CH_4 emissions are kept constant.
CO_2 emissions from the solid waste disposal on land sites originate when recovered emissions are used or flared via installations with energy recuperation. These emissions are reported in the energy sector (see 2.2.3.).

CH_4 and N_2O emissions from waste water handling in Flanders are based on projections with respect to the evolution of population and of the number of people connected to waste water handling systems until 2020. Connection percentage was 67% in 2007 and is estimated to go linearly up to 87% in 2020.
CO_2 emissions from municipal waste water treatment are not included in the projections because these emissions derive from biomass raw materials.

The waste incineration category includes incineration of municipal and industrial waste, incineration of hospital waste and the incineration of corpses.
Emissions of N_2O (CH_4 is not relevant here) from these activities are kept constant at current emission levels.
In Flanders only the fraction of organic-synthetic waste is taken into consideration to estimate the CO_2 emissions originating from waste incineration. As mentioned before the projections of the waste incineration plants with energy recuperation and the emissions originating from flaring activities are allocated to the energy sector.

CH_4 emissions from composting in Flanders are kept constant at current emission levels.

Wallonia

Projections of CH_4 emissions from the solid waste disposal on land in Wallonia take the implementation of the Order of the Walloon Government of 18 March 2004 banning the dumping of organic waste into landfills. The dumping of organic waste is assumed to decline until 2010. Also its DOC content is assumed to decline. The recovery rate of landfill gas is assumed to remain constant at its level of 2007. CO_2 emissions from the solid waste disposal on land sites originate when recovered emissions are used or flared via installations with energy recuperation. These emissions are reported in the energy sector (more detail see 2.2.3.).

CH_4 and N_2O emissions of waste water handling in Wallonia are kept constant at current emission levels. CO_2 emissions from municipal waste water treatment are not included in the projections because the carbon derives from biomass raw materials.

The waste incineration category includes incineration of municipal and industrial waste, incineration of hospital waste and the incineration of corpses. Emissions of N_2O (CH_4 is not relevant) from these activities are kept constant at current emission levels. The CO_2 emission projections originating from hospital waste incineration are integrated in the waste incineration sector. The emission projections of the municipal waste incineration plants (with energy recuperation) are allocated to the energy sector.

CH_4 emissions from composting in Wallonia are kept constant at current emission levels

Brussels region

There are no waste disposal sites in the Brussels region.

N_2O emissions of waste water handling in Brussels region are estimated applying equation 6.8 of "2006 IPCC Guidelines for National Greenhouse Gas Inventories" and are supposing to follow the population growth.
No CH_4 emissions are reported in this category because biogas produced feed a CHP installation.

The waste incineration category includes incineration of municipal and hospital waste and the incineration of corpses. Emissions of N_2O (CH_4 is not relevant) from these activities are kept constant at current emission levels.
CO_2 emissions from waste incineration are allocated to the energy sector.

There are no compost-producing activities in the Brussels region.

3. The 'with measures' greenhouse gas emission projections

The following tables report the 2006 Belgian greenhouse gas emissions and the compiled 2009 '<u>with measures</u>' projections for the years 2010 (mean for period 2008-2012), 2015 and 2020.

Reference year 2006 (inventory 2009)

CRF format (kton CO_2-eq)	CO_2	CH_4	N_2O	F	SUM
1 Energy	109 030	729	1 143	0	110 902
1A Fuel combustion	108 898	310	1 143	0	110 351
1A1 Energy industries	27 657	14	151	0	27 822
1A2 Manufacturing industries and construction	27 438	65	46	0	27 550
1A3 Transport	25 193	58	811	0	26 062
1A4 Commercial / residential / agriculture	28 481	172	133	0	28 787
1A5 Other	129	0	1	0	130
1B Fugitive emissions from fuels	132	419	0	0	551
2 Industrial processes	9 977	57	2 565	1 828	14 427
3 Solvent and other Product Use	0	0	247	0	247
4 Agriculture	0	5 133	4 707	0	9 840
5 Land-Use Change and Forestry	0	0	0	0	0
6 Wastes	78	850	272	0	1 200
7 Other	0	0	0	0	0
Total	**119 085**	**6 765**	**8 934**	**1 828**	**136 612**

Year 2010 (mean for period 2008 – 2012)

CRF format (kton CO_2-eq)	CO_2	CH_4	N_2O	F	SUM
1 Energy	108 389	616	1 165	0	110 170
1A Fuel combustion	108 243	232	1 165	0	109 786
1A1 Energy industries (including CHP)	27 330	2	88	0	27 420
1A2 Manufacturing industries and construction (without CHP)	25 012	57	81	0	25 151
1A3 Transport	24 901	24	840	0	25 765
1A4 Commercial / residential / agriculture	30 898	148	157	0	31 202
1A5 Other	102	0	0	0	102
1B Fugitive emissions from fuels	146	384	0	0	530
2 Industrial processes	10 975	58	3 032	2 173	16 238
3 Solvent and other Product Use	0	0	219	0	219
4 Agriculture	0	4 909	4 333	0	9 241
5 Land-Use Change and Forestry	0	0	0	0	0
6 Wastes	85	582	277	0	943
7 Other	0	0	0	0	0
Total	**119 448**	**6 164**	**9 026**	**2 173**	**136 811**

Year 2015

CRF format (kton CO_2-eq)	CO_2	CH_4	N_2O	F	SUM
1 Energy	118 246	613	1 202	0	120 061
1A Fuel combustion	118 113	229	1 202	0	119 544
1A1 Energy industries (including CHP)	36 607	2	89	0	36 698
1A2 Manufacturing industries and construction (without CHP)	26 224	58	83	0	26 364
1A3 Transport	24 741	22	876	0	25 638
1A4 Commercial / residential / agriculture	30 439	148	155	0	30 742
1A5 Other	102	0	0	0	102
1B Fugitive emissions from fuels	133	384	0	0	517
2 Industrial processes	12 469	58	3 239	2 367	18 134
3 Solvent and other Product Use	0	0	219	0	219
4 Agriculture	0	5 144	4 374	0	9 518
5 Land-Use Change and Forestry	0	0	0	0	0
6 Wastes	85	280	285	0	650
7 Other	0	0	0	0	0
Total	**130 799**	**6 095**	**9 319**	**2 367**	**148 580**

Year 2020

CRF format (kton CO_2-eq)	CO_2	CH_4	N_2O	F	SUM
1 Energy	120 242	617	1 243	0	122 102
1A Fuel combustion	120 122	233	1 243	0	121 598
1A1 Energy industries (including CHP)	39 254	2	91	0	39 347
1A2 Manufacturing industries and construction (without CHP)	25 392	57	84	0	25 532
1A3 Transport	25 014	21	915	0	25 950
1A4 Commercial / residential / agriculture	30 361	152	154	0	30 667
1A5 Other	102	0	0	0	102
1B Fugitive emissions from fuels	120	384	0	0	504
2 Industrial processes	12 369	58	3 446	2 465	18 338
3 Solvent and other Product Use	0	0	219	0	219
4 Agriculture	0	5 026	4 338	0	9 364
5 Land-Use Change and Forestry	0	0	0	0	0
6 Wastes	85	227	291	0	603
7 Other	0	0	0	0	0
Total	**132 695**	**5 929**	**9 536**	**2 465**	**150 625**

Overview

CRF format (kton CO_2-eq)	2006 (inventory 2009)	2010 (mean 2008-2012)	2015	2020
1 Energy	110 902	110 170	120 061	122 102
1A Fuel combustion	110 351	109 786	119 544	121 598
1A1 Energy industries (including CHP)	27 822	27 420	36 698	39 347
1A2 Manufacturing industries and construction (without CHP)	27 550	25 151	26 364	25 532
1A3 Transport	26 062	25 765	25 638	25 950
1A4 Commercial / residential / agriculture	28 787	31 202	30 742	30 667
1A5 Other	130	102	102	102
1B Fugitive emissions from fuels	551	530	517	504
2 Industrial processes	14 427	16 238	18 134	18 338
3 Solvent and other Product Use	247	219	219	219
4 Agriculture	9 840	9 241	9 518	9 364
5 Land-Use Change and Forestry	0	0	0	0
6 Wastes	1 200	943	650	603
7 Other	0	0	0	0
Total	**136 616**	**136 811**	**148 580**	**150 625**

The greenhouse gas emissions in the with measures scenario (including all climate policy measures approved so far) are expected to remain approximately at the 2006 emission level up to 2010. The assumed increased electricity demand combined with the nuclear phase out (most of the nuclear capacity phased out is assumed to be replaced by new CCGT-power plants), the assumed increase in iron and steel production and increased production in other industrial sectors are the main factors explaining the significant increase in emissions after 2010.

4. Emission projections covered by EU ETS versus allowances allocated in the National Allocation Plan

The tables below provide an estimate of the Belgian emission projections from the relevant sectors covered by ETS in 08-12 or 13-20 for the years 2010, 2015 and 2020. A distinction has been made whether the scope 08-12 or 13-20 of EU ETS is used.

'Relevant' CO_2 that has been taken into account in the table below, are CRF-categories 1A1 ('Energy industries'), CRF-category 1A2 ('Manufacturing industries and Construction'), CRF-category 2A1 ('Cement production'), CRF-category 2A2 ('Lime production'), CRF-category 2A7 ('Others'), CRF-category 2B1 (Ammonia production in chemical industry'), CRF-category 2B5 ('Other process emissions in chemical industry') and CRF-category 2C1 ('Iron and steel production').

'Relevant' N_2O that has been taken into account in the table below, is CRF-category 2B2 ('Nitric Acid production') and 2B5 ('i.e. caprolactam).

Belgian emission projections for relevant CRF-categories			
	2010	**2015**	**2020**
'relevant' CO_2	64 221	76 411	80 895
'relevant' N_2O	3 031	3 238	3 445
Total 'relevant' emission projections	**67 252**	**76 649**	**84 340**

The steep rise of CO_2-emissions between 2010 and 2020 relates mainly to projected emission growths in the electricity sector (CRF category 1A1) and the iron and steel sector (CRF-categories 1A2a and 2C1).

Of those projected emissions, an estimate has been made to identify whether emissions fall under ETS or not. For this exercise, the year 2010 takes into account scope 08-12, the years 2015 and 2020 take into account scope 13-20.

Belgian emission projections under EU ETS			
	2010 (scope 08-12)	**2015 (scope 13-20)**	**2020 (scope 13-20)**
'relevant' CO_2	57 148	72 814	76 975
'relevant' N_2O	0	2 975	3 182
Total	**57 148**	**75 789**	**80 157**
% of total 'relevant' emission projections	**85.0%**	**95.2%**	**95.0%**

Comparison with Belgian National Allocation Plan 08-12

The mean allocation for sectors under ETS in 08-12 in Belgium (see Commission Decision on the Belgian NAP-table 08-12 of 10-Oct-08), amounts 292.472 mio. allowances for the 08-12 period, or 58.494 mio. allowances per year. This yearly amount incorporates an allocation to incumbents of 52.941 mio. allowances and a reserve of 5.553 mio. allowances. It will depend on the actual use of the New entrants reserve whether the allocation will be higher/lower then the verified emissions.

Effect of extension of the scope in 13-20

The extension of the scope in 13-20 will be responsible (indicated by the % of the total relevant emissions projections under ETS) for more emissions from the above mentioned CRF-categories under EU ETS. This mainly relates to the fact that Belgium has two nitric acid production sites, and the above mentioned fact that increase in emissions is expected in the electricity sector and the iron and steel sector, thus resulting in a bigger part of the emission projections that will fall under ETS.

5. Sensitivity analysis of the 'with measures' greenhouse gas emission projections

As a first sensitivity analysis the compiled regional projections are compared with national projections calculated with the econometric HERMES model. In other words this is a comparison of the technological bottom-up approach with the macro-economic top-down approach.
Furthermore sensitivity analyses are performed for some other important parameters such as number of degree-days, nuclear phase out, etc. without however taking indirect effects into account.

5.1. COMPARISON WITH MACRO-ECONOMIC TOP DOWN APPROACH

The regional projections were calculated using a bottom-up approach, in which there is no direct link between the calculated projections and the macro-economical context (see 1.2.). In order to validate this approach the compiled regional projections have been compared with national projections developed by the Federal Planning Bureau based on a macro-sectoral top-down econometric model (HERMES) and a recent study commissioned by the Belgian federal and three regional authorities, based notably on the PRIMES energy model. These national modelled projections are more closely linked to macro-economical assumptions.

Total Greenhouse Gas emissions (CO_2-eq in Mton)	Belgium HERMES projections **2006***	Belgium HERMES projections **2010**	Belgium HERMES projections **2015**	Belgium HERMES projections **2020**
1A Fuel combustion	110.4	106.4	110.8	115.4
1A1 Transformation	29.4	26.1	30.3	36.5
1A2 Industry	25.5	27.0	27.5	26.3
1A3 Transport	26.0	25.5	25.6	25.7
1A4 Commercial / residential / agriculture	29.4	27.7	27.3	26.8
1A5 Other	0.1	0.1	0.1	0.1
1B Fugitive emissions from fuels	0.5	0.5	0.5	0.5
2 Industrial processes	14.4	12.9	13.5	13.5
3 Solvent and other product use	0.2	0.2	0.2	0.2
4 Agriculture	9.8	9.4	8.9	8.5
6 Wastes	1.2	1.0	0.8	0.7
Total	**136.7**	**130.4**	**134.8**	**139.0**

* The 2006 data is calibrated on the 2006 emission inventory. Although total emissions correspond to the total reported in the CRF tables, there is a difference for the sectors 1A1 and 1A2 between the Hermes data and the CRF data due to a different methodology. HERMES calculations are based on data from the energy balance of Eurostat while the CRF inventory data are calculated based on the regional energy balances.

Although the top-down projections differ from the bottom-up projections, both projections show similar tendencies for the period 2010 -2020, i.e.

- increase of emissions after 2010 in the transformation sector .and industrial processes;
- transport emissions remain at the 2006-level until 2020;
- emissions from energy consumption in commercial, residential and agriculture sectors remain at the 2010 level until 2020.

The difference between the two projections boils down to different expectations regarding the evolution for the 2008 – 2012 period. This difference is due to the particular short term economic context (high oil prices in 2008, economic slow down in 2008, 2009) and the way the different models used respond to these. Macro-economic models such as HERMES are more sensitive to price

variations than technical-economic models such as MARKAL and simulation models based on activity levels, such as EPM.

The top-down HERMES projections expect a significant decrease of total emissions between 2006 and 2010 while the average bottom-up projections for the Kyoto period stay relatively constant.

5.2. NUMBER OF DEGREE-DAYS

Climate assumptions are an important parameter for the energy use of households and the commercial sector (also for the energy use in the greenhouse sector, but global impact here is minimal).

The 'with measures' projections are calculated for 1900 degree-days. In case the future climate would be milder (1714 degree days), CO_2 emissions from the buildings sector would be **2.1 Mton CO_2 lower in 2020**.

CO_2 projections 2020 (kton)	1714 degree-days	1900 degree-days
Residential sector	20 897	22 553
Tertiary sector	5 620	6 082
Total	**26 517**	**28 635**

5.3. NUCLEAR PHASE OUT

The 'with measures' scenario integrates the Belgian Law on the progressive phase-out of nuclear energy. It thus takes the decommissioning of nuclear power plants once they turn 40 into account, conform the Law on the progressive phase-out of nuclear energy for industrial electricity production which has been consented by the federal government on January 31, 2003. In this scenario, the decommissioned nuclear plants are mostly replaced by new CCGT-power plants.

In case nuclear capacity is kept at its 2010 level, total CO_2 emissions would be about **6.3 Mton CO_2** less in 2020.

5.4. ECONOMIC GROWTH

Economic growth is an important exogenous variable in developing projections. To get an idea of the sensitivity of this variable, projections were calculated with a lower economical growth.
In case that the national economic growth between 2011 and 2020 (GDP growth) does not reach more than 1.5% a year (instead of the current assumption of 2 %), the GHG emissions (essentially energetic CO_2) would decrease by **6.9 to 7.7 Mton in 2020**, compared to the reference scenario, depending on how the economic slowdown is allocated among sectors. The more industry is affected, the more important is the decrease in GHG emissions.
Similarly, in case of a higher economic growth than assumed in the 'with measures' scenario, corresponding increases of the GHG emissions can be expected."

5.5. ELECTRICITY DEMAND

The bottom up analysis of electricity demand in the with measures scenario shows an average annual increase of electricity demand in Belgium of 1.1% for the period 2010-2015 and of 0.9 % for the period 2015-2020.

In case the average annual increase of electricity demand would be 0.7% for the period 2010 – 2020, CO_2-emissions would drop by **0.9 Mton CO_2** in 2020. The lower electricity consumption leads in the MARKAL analysis to a decreased production of electricity from CCGT plants and renewable sources (off shore wind, photovoltaic).

5.6. ELECTRICITY IMPORT

In a scenario where sufficient additional electricity production capacity is installed on Belgian soil and import and export becomes in balance at 2020 (net import is zero), the total CO_2 emission in 2020 would increase with about **2 Mton.** In the MARKAL model analysis the import is mostly replaced by new CCT gas plants and renewable energy production (on shore and off shore wind, photovoltaïc).

In case the net import level is doubled in 2020 compared to the level assumed in the with measures scenario, the total CO_2 emission in 2020 would decrease with about **2 Mton.** The model reduces in this case the electricity production by CCGT-plants and from renewable sources (off shore wind, photovoltaic).

6. ‘With additional measures’ greenhouse gas emission projections

6.1. ADDITIONAL MEASURES

The scenario ‘With additional measures’ focuses on the electricity production sector (renewable energy production) and on the non-ETS sectors since the emissions in the ETS-sector related to fossil fuel consumption will be regulated by the harmonised EU ETS cap.

6.1.1. Federal government

Energy production

(1) Increase in the share of off shore wind energy to 2000 MW in 2020 (measure implemented by the federal government)

6.1.2. Flanders

Flanders is in the process of defining measures to meet the objectives of the European Energy Climate Package by 2020. At the time of establishing these projections the design of following measures and ideas was mature enough to be incorporated in the ‘With Additional Measures’ scenario. It is important however to underline that the estimates of their impact, as reported here, is the result of a first analysis and that this analysis needs to be supplemented with socio-economic analyses of the feasibility. Also, as with the ‘with measures’ scenario, uncertainties exist regarding these projections. These were not analysed so far.

Energy production

(1) Increasing the share of renewable in the total domestic electricity demand of 6.8 % in the ‘with measures’ scenario in 2020 (excluding off shore wind energy) to 13%.

Residential sector

(1) Additional measures affecting new buildings in the residential sector:
   - gradual tightening of the energy performance requirements for new dwellings, starting from an E-level of 80 in 2010;

(2) Additional measures affecting existing buildings in the residential sector result in an additional energy saving potential of 20% in 2020 compared to the 'with measures' scenario. To meet this objective, increasing the RUE-service obligations imposed on the grid operators is proposed. This includes a.o. extra premiums for energy saving investments, free energy scans in dwellings, awareness and information programmes.

These measures result in 11 972 GWh of energy saved and/or a reduction of 2.8 Mton CO_2-eq in 2020 compared to the 'with measures' level for that year.

Transports

(1) Additional measures affecting mobility demand;

(2) Measures to stimulate the use of eco-friendly vehicles and combustions resulting in lower average CO_2 emissions
(3) Measures stimulating a fuel-efficient driving behaviour

6.1.3. Wallonia

Wallonia is currently updating its Plan for a sustainable energy management, in order to establish the guidelines required to meet objectives of the European Energy Package by 2020.

At the time the present projections were established, the project of new Plan has been presented for a first reading to the Regional Government and was submitted to a discussion with stakeholders representing the various parts of society. Thus, it was still an unofficial document which had not yet been approved by Regional authorities.

Nevertheless, this project of new Plan is used here to establish the hypotheses of a scenario "with additional measures".

Residential sector

For the residential sector, the plan aims at two distinct targets by 2020:

- All new constructions should be passive or low energy dwellings;
- An overall energy saving of 20% on the existing buildings

To meet those objectives, the plan proposes to raise public consciousness by numerous information campaigns, educational programmes in schools and formation sessions aiming at professionals of the buildings sector. It relies on progressively stricter requirements of the energy performance of new dwellings and amplifies the various financial and fiscal incentives to energy improvements on existing buildings and to low energy new constructions performing better than the required standards.
It also addresses a series of non technical obstacles, proposing measures such as :

- incentives to owners whose property is rented;
- compulsory energy certification for any contract linked to the dwelling;
- adaptation to urbanisation regulations to facilitate energy saving operations on buildings (modifying the outdoor aspect of houses for instance);
- …

Considering technical measures that would be implemented in this frame, fuels savings of some 8 726 GWh are estimated, yielding a potential reduction of some 2 Mt of CO_2 emissions by 2020, when compared to emissions in the framework of the "with measures scenario".
In addition, some 379 GWh of electricity could also be saved.

Tertiary sector

Similar principles apply to the tertiary sector. New buildings should by 2020 respect "low energy standards" for heating and avoid air conditioning. Energy consumptions of existing buildings should be reduced by 20%.
Actions also combine information and education efforts, demonstration projects, regulations and incentives.
Expected energy savings amount to 1 238 GWh on fuels (yielding a CO_2 emissions reduction of 0.3 Mt) and
1 038 GWh on electricity

Industry

No additional measures are considered in the industrial sector regarding fossil fuel emissions, the Emission Trading process and a foreseeable continuation of long term agreements on the period 2012-2020 being already considered in the framework of the scenario "with measures".

Regarding the process emission from the production of nitric acid in the Walloon region, investment in N_2O catalytic abatement technology (SCR) is foreseen on the 2 installations which have no specific treatment in place for the time being. This measure would lead to a reduction of the N_2O emissions, estimated at 0.5 Mt CO_2-eq. in 2015 and 2020.

Transports

The plan identifies three axes of actions to reduce the fuel consumption of road transports :

- improve the performance of vehicles (acting on engines, aerodynamics, tires pressure, but also driving behaviours);
- promote modal transfers (to public transports and soft transports means for people and to railways or waterways for goods);
- integrate energy saving concerns in all aspects of the society organisation in order to reduce the needs of mobility (promote teleworking and videoconferences, optimize the distance between commercial and activity areas and dwellings locations, …).

We assume here that an overall fuel saving of 4 648 GWh by 2020 (with respect to the consumption in the framework of the scenario "with measures") and a CO2 emissions reduction of 0.87 Mt are feasible.

Energy production

The plan also considers a wide increase in the use of renewable energies and high efficiency CHP.

By 2020, it envisages that 2250 GWh of electricity would be produced bt on-shore windmills, 440 GWH by hydroelectricity and 1175 GWh using biomass. High efficiency CHP should produce 3 100 GWh of electricity

6.1.4. Brussels region

Transports

Around the turn of the century, the Regional authorities have established an objective to reduce the overall mobility of road transports by 20% between 2000 and 2015. Various measures that would have to be applied in order to meet that drastic objective are still in a testing phase or in discussion. However, authorities of the Metropolitan Region consider of prime importance to curb the rising vehicles mobility in the city.

Therefore, and though at the present time only a very approximate estimate may be evaluated, the emission reduction potential linked to this objective is evaluated here.

It is assumed that the reduction in mobility by road is obtained through modal shifts. As no particular project addresses yet the mobility of freight by duty vehicles, we assume that the objective is met by reducing the mobility of individual cars only[5]. Modal shift is assumed to be the following:

- 20% of trips not performed by cars anymore, are replaced by walks, bicycle rides or subway trips;
- 40% are replaced by tramway rides;
- 40% by busses.

Only the increasing number of busses contributes to GHG emissions[6]. Considering that the average attendance of a bus is ± 20 persons (70 at peak hours), we assume that every 20 car trips suppressed are replaced by 1 more bus on the road (this does not modify the mean attendance and ensures that overcrowded busses are avoided).

The projection thus operates a reduction of mobility of personal cars of some 0.6 billion vehicle kilometres with respect to 2000, and a rise in bus travel of 0.012 billion vehicle kilometres.

We assume that the mobility reduction occurs linearly between 2007 and 2015, thus already impacting emissions in 2010, and that road mobility is contained at its level after 2015. With respect to the 'with measures' scenario, the measures to reduce the cars mobility reaches a CO_2 emission reduction of 101 kton CO_2 by 2020. In addition a small reduction of N_2O and CH_4 is also obtained (respectively 5 and 0.1 kton CO_2 eq). Roughly, the application of the objective presents a potential of reduction by 2015-2020 of approximately 2.5% of the global emission level of the Brussels Metropolitan Region in 2005.

Building sector

The Brussels Region is in the process of defining measures to meet the objectives of the "Covenant of Mayors" which commit the city to go beyond the objectives of EU energy policy in terms of reduction in CO_2 emissions, reducing the CO_2 emissions by 20%.

Achieving this objective in building sector by 2020 represents a reduction in GHG emissions of 585 kton CO_2 eq compared to BAU projections[7].

Among measures considered to achieve this objective in the building sector :

- reinforce the periodic inspection of boilers and HVAC systems as well as the energy performance requirements;
- prompt large companies to audit their consumption and to implement an energy management programme,
- continue to support financially the exemplary constructions and renovations (better performances than the required standards);
- implement a new integrated service agency to help households to design their renovations based on audit report, to select the best technical option in term of energy saving and return on investment;

[5] Roughly, this means a reduction by 30% on cars to meet an overall reduction of mobility for the global traffic
[6] Currently, the number of trips performed by tramway or by bus are quite equivalent (STIB : Contrat de Gestion, Rapport quinquennal).
[7] Due to time issues, this potential reduction is considered nowhere else in the reporting

- set up an operator that finances and organizes a system of third-investor adapted to residential sector.

6.2. WITH ADDITIONAL MEASURES PROJECTIONS

CRF format (kton CO_2-eq)	2006 (inventory 2009)	2010 (mean 2008-2012)	2015	2020
1 Energy	110 902	110 308	116 806	114 250
1A Fuel combustion	110 351	109 778	116 290	113 746
1A1 Energy industries (including CHP)	27 822	27 629	35 494	35 687
1A2 Manufacturing industries and construction (without CHP)	27 550	25 134	26 298	25 521
1A3 Transport	26 062	25 710	24 671	24 142
1A4 Commercial / residential / agriculture	28 787	30 959	28 243	25 509
1A5 Other	130	102	102	102
1B Fugitive emissions from fuels	551	530	517	504
2 Industrial processes	14 427	16 238	17 383	17 838
3 Solvent and other Product Use	247	219	219	219
4 Agriculture	9 840	9 241	9 518	9 364
5 Land-Use Change and Forestry	0	0	0	0
6 Wastes	1 200	943	650	603
7 Other	0	0	0	0
Total	**136 616**	**136 706**	**143 094**	**139 489**

The additional measures represent an estimated total additional reduction of about 11.1 Mton CO_2 eq in 2020.

7. Conclusion

7.1. OVERALL EMISSION LEVELS

The total greenhouse gas emissions in the 'with measures' scenario remain approximately constant at the 2006 level until 2010 (**136.8 Mton CO_2-eq)** and increase afterwards up to **150.6 Mton** in 2020, which is largely due to the increased electricity demand, the planned decommissioning of the first nuclear reactors in 2015 and an increase in industrial production. These projections do not include emissions nor removals from LUCF.

Projections with the macro-economic model suggest a significant decrease in emissions between 2006 en 2010 (**130,4 Mton CO_2-eq**), resulting also in a lower emission level in 2020 (**139.0 Mton CO_2-eq**). Both model approaches suggest an increase of emissions after 2010.

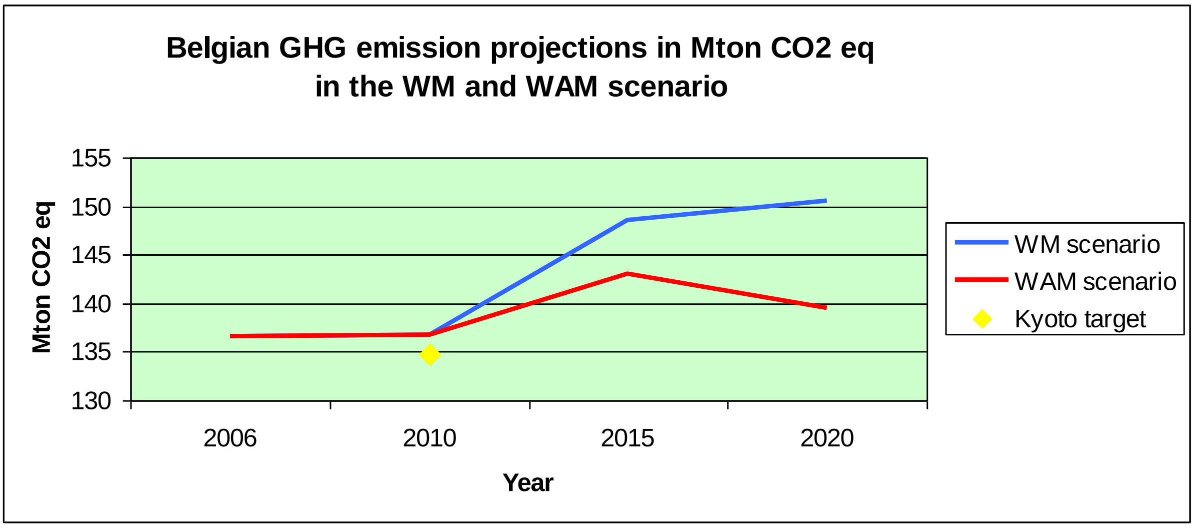

Fig. 1 Total Belgian GHG emission projection in the WM and WAM scenario (Mton CO_2 eq)

Uncertainties concerning exogenous variables such as economic growth, climate conditions, electricity imports exist and their level influences the resulting greenhouse gas emissions, notably in the sectors covered by the EU ETS.

The proposed additional measures show an additional reduction potential of 11.1 Mton in 2020, reducing the total CO_2-eq in the 'with additional measures' scenario to **139.5** Mton CO_2-eq.

7.2. COMPARISON WITH THE KYOTO TARGET: NON-ETS EMISSIONS ARE THE DETERMINING FACTOR

The annual average quantity of allowances for Belgium in the Kyoto period equals 134.8 mio AAUs. The overall emission level in the 'With Measures' Scenario is 136.8 Mton CO_2-eq or 2 Mton CO_2-eq above this target.

With the approval of the National Allocation Plan for the period 2008 – 2012 however, the Kyoto target is translated into a target for the sectors not covered by the EU ETS. This target equals 76.3 Mton CO_2-eq[8]. Following the analysis in Chapter 4 of this section, the average non-ETS emission level in Kyoto period is estimated to be **79.7 Mton CO_2-eq[9] or 3.4 Mton CO_2-eq** above the target. This difference determines the amount of flexibility mechanisms Belgium will use in the Kyoto period (see Section 4 of this report).

[8] The Belgian Kyoto target (134.8 Mton) – the mean Belgian ETS-cap for the 08-12 period (58.5 Mton)
[9] The overall estimated emission level in 2010 is 136.8 Mton of which 57.1 Mton projected emissions estimated to be covered by the EU ETS (scope 08-12). The difference between the two is therefore the emission level not covered by the ETS.

Annex 1. Description of used models

I. MARKAL

MARKAL is a technical-economic model, which assembles in a simple but economically consistent way technological information (conversion-efficiency, investment- and variable costs, emissions, etc.) for the entire energy system. It can represent all the energy demand and supply activities and technologies for local, national or multi-regional energy systems over a horizon of 30/50 years, with their associated emissions (CO, CO_2, SO_2, NO_X, VOC and PM) and the damages generated by these emissions. It is usually applied for the analysis of the entire energy sector, but may also be applied to study in detail single sectors (e.g. the electricity and district heat sector).

Reference case estimates of end-use energy service demands (e.g. car road travel; residential lighting; steam heat requirements in the paper industry; etc.) are provided by the user. In addition, the user provides estimates of the existing stock of energy related equipment in all sectors, and the characteristics of available future technologies, as well as present and future sources of primary energy supply and their potentials.

Using these as inputs, the MARKAL model aims to supply energy services at minimum global cost (more accurately at minimum loss of surplus) by simultaneously making decisions on equipment investment and operating, primary energy supply and energy trade. For example, if there is an increase in residential lighting energy service relative to the reference scenario (perhaps due to a decline in the cost of residential lighting), either existing generation equipment must be used more intensively or new – possibly more efficient – equipment must be installed. The choice by the model of the generation equipment (type and fuel) is based on the analysis of the characteristics of alternative generation technologies, on the economics of the energy supply, and on environmental criteria. MARKAL is thus a vertically integrated model of the entire extended energy system.

The scope of the model extends beyond purely energy oriented issues, to the representation of environmental emissions, and perhaps materials, related to the energy system. In addition, the model is admirably suited to the analysis of energy-environmental policies, which may be represented with accuracy thanks to the explicitness of the representation of technologies and fuels in all sectors.

In MARKAL the quantities and prices of the various commodities are in equilibrium, i.e. their prices and quantities in each time period are such that the suppliers produce exactly the quantities demanded by the consumers. This equilibrium has the property that the total consumer and producer surplus is maximised.

The MARKAL model is particularly suited to the exploration of possible energy futures based on contrasted scenarios. Given the long horizons simulated with MARKAL, the scenario approach is really the only choice (whereas for the shorter term, econometric methods may provide useful extrapolations of the past). Scenarios, unlike forecasts, do not pre-suppose knowledge of the main drivers of the energy system. Instead, a scenario consists of a set of coherent assumptions about the future trajectories of these drivers, leading to a coherent organisation of the system under study. A scenario builder must therefore carefully test the assumptions made for internal coherence, via a credible story-line.

In MARKAL, a complete scenario consists of four types of inputs:

- energy service demands
- primary resource potentials
- policy setting
- the descriptions of a set of technologies.

We now present a few comments on each of these four components.

The Demand Component

In the case of the MARKAL model, a set of energy service demands over the time horizon is obtained externally, via other models or from accepted other sources. The model can use general equilibrium models to generate a set of coherent demand parameters. Drivers for these demands in a MARKAL model have to be determined and quantified outside of the model.

The model is a **partial equilibrium** model and thus can take into account price effects. This is done by choosing elasticities of demands to their respective prices, in each region.

When the model is run for alternative scenarios (for instance for an emission constrained case, or for a set of alternate technological assumptions), it is likely that the demands will be affected. MARKAL has the capability of estimating the response of the demands to the changing conditions of an alternate scenario. To do this, the model requires the assumed elasticities of the demands to their own prices. MARKAL is then able to endogenously adjust the demands to the alternate cases without exogenous intervention. The prices are determined by the model under the assumption of perfect competition. In that case, prices are equal to the marginal cost of production. In fact, this means that the MARKAL model is not driven by demands but by demand curves.

The Supply Component

The second constituent of a scenario is a set of supply curves for primary energy and material resources. Multi-stepped supply curves can be easily modelled in MARKAL, each step representing a certain potential of the resource available at a particular cost. In some cases, the potential may be expressed as a cumulative potential over the model horizon, as a cumulative potential over the resource base (e.g. available areas for wind converters differentiated by velocities, available farmland for biomass, roof areas for PV installations) and in others as an annual potential (e.g. maximum extraction rates, or for renewable resources the available wind, biomass, or hydro potentials).

The Policy Component

Insofar as some policies have an impact on the energy system, they may become an integral part of the scenario definition. For instance, a No-Policy scenario may perfectly ignore emissions of various pollutants, while alternate policy scenarios may enforce emission restrictions, or emission taxes, etc. The detailed technological nature of MARKAL allows the simulation of a wide variety of both micro measures (e.g. technology portfolios, or targeted subsidies to groups of technologies), and broader

policy targets (such as general carbon tax, or permit trading system on air pollutants). A simpler example might be a nuclear policy that limits the future capacity of nuclear plants. Another example might be the imposition of fuel taxes, or of industrial subsidies, etc.

While the primary focus of the model is on climate change policy, it can also contribute to the evaluation of other policies. This can be energy policies, e.g. investment/rational use of energy, both on the demand and the supply side, or conventional air pollution policies within the energy system. More concrete, this project will contribute to the following objectives:

- determine the GHG-emission targets, which a country can achieve in the long term, i.e. after Kyoto.
- determine what are the possibilities of achieving these targets partly abroad (using the flexible mechanism defined within the Kyoto protocol)
- determine which sectors or technologies have to be considered in priority for GHG emission reduction
- evaluate the interaction between climate change policy and other policies related to the energy system

The Technical-economic component

The fourth and last constituent of a scenario is the set of technical and economic parameters assumed for the transformation of primary resources into energy services. In MARKAL, these technical-economic parameters are described in the form of technologies (or processes) that transform some commodities into others (fuels, materials, energy services, emissions). In MARKAL, some technologies may be imposed and others may simply be available for the model to choose. The quality of a MARKAL model rests on a rich, well developed set of technologies, both current and future, for the model to choose from. MARKAL contains a few hundred existing and future energy technologies.

The emphasis put on the technological database is one of the main distinguishing factors of the class of Bottom-up models, to which MARKAL belongs. Other classes of models will tend to emphasize other aspects of the system (e.g. interactions with the rest of the economy) and treat the technical system in a more succinct manner via aggregate production functions.

II. EPM MODEL

EPM (Energy/Emissions Projection Model) is a projection model for energy demand and atmospheric emissions that covers all relevant emission sectors (energy sector, industry, residential, commercial, transport). It has been developed progressively by ECONOTEC since 1993 in the framework of a number of studies carried out for public authorities, as well as regional as at national level.

Given the heterogeneity of sectors such as the iron & steel industry, the chemical sector or the residential sector, it is necessary to take into account internal structural effects, i.e. the difference in evolution of sub-sectors when these sub-sectors have different levels of specific consumptions or emissions.

EPM is a simulation model, of the “bottom-up” type, i.e. explaining energy consumptions and GHG emissions from activity variables expressed as far as possible in physical units, and containing a detailed representation of emission sources and the main determining factors of the evolution of energy demand and the various types of emissions.

This methodological option is based on the observation that there is no simple and homogeneous relationship between aggregated macroeconomic variables expressed in monetary value and actual energy consumption.

The model, which includes a techno-economic data base on the energy consumption and emission reduction measures, is used in particular for:

- the construction of a reference scenario (business as usual), representing the
- expected future evolution in the absence of any new emission reduction policy;
- evaluating economic emission reduction potentials;
- constructing emission reduction scenarios, based on the reduction measures with a marginal cost below a given ceiling;
- constructing cost curves, providing either the marginal or the total cost as a function of the level of emission or energy consumption reduction;
- assessing the impact of existing or draft legislations on energy consumptions,
- emission levels and costs.

The present model description is focused on energy consumptions and CO_2 emissions, but the situation is similar for other atmospheric pollutants CH_4, N_2O, SO_2, NOx and VOCs. The case of fluorinated gases, which has been handled for the Federal Department of the Environment, requires a more specific approach.

Sectoral disaggregation

Industry is represented by about a hundred activity variables (pig iron production, oxygen steel production, ethylene production, clinker production, flat glass production…). The large energy consumption branches are modelled in more detailed than the others. For example, iron & steel production is taken into account per workshop (agglomeration, blast furnace, oxygen steel production…); for the chemical industry about twenty basic products are distinguished.

In the residential sector are considered existing and new houses, existing and new apartments (electric and non electric heated), domestic water heating and 10 specific uses of electricity (cooking, refrigerators, washing machines, dryers…). The heat load is estimated using a separate module, from a typology of the building stock composed of 14 type-dwellings, of which the dimensioning and the thermal characteristics are entirely defined. In this module, the energy consumptions are calculated using the performances of 15 heat production, distribution or emission systems. In the tertiary sector, about 30 sub-sectors are grouped into 8 categories, and 5 energy uses are distinguished (heating, ventilation, cooling, lighting and other electric uses). The activity variable is the floor area of buildings.

In the transportation sector, one distinguishes between road transportation of persons, road transportation of goods, rail transportation and inland water transportation. For road transportation, the modelling is carried out in a separate module allowing to calculate emission levels as a function of the average specific energy consumptions of vehicles at the time of their first use and taking into account (European) regulations on polluting emissions applicable at that time.

For each sector, the energy consumptions are divided by use of energy (heating, fans, compressors, cooling, lighting…). For each emission source, the reduction measures are identified, as a function of the use of energy, and costs and performances are evaluated, as well as the technical potential of these measures. By measure, by sector, by energy use and by year, the model calculates the cost per tonne of CO_2 as the sum of the annualised investment cost and the operating costs, minus the value of the energy saving achieved. The latter is a function of the energy carrier, the sector, the year and a possible tax.

Reference scenario

In a first step, energy consumptions and emissions are calculated for a reference year, recent past year serving as a basis for the projections. These consumptions and emissions are then projected into the future on the basis of assumptions on evolutions of various factors (activity variables, specific consumptions, emission factors).

Two emission categories are considered: emissions linked to energy consumption and “process” emissions.

Emissions of the reference year

The basic data used for the reference year are the energy consumptions of the statistical energy balances (by sector and by energy carrier). Some corrections are applied to these consumptions, e.g. a climatic correction on energy consumptions for space heating, so as to obtain an average climate, and hence to project an average climate.

However, these energy balances are generally quite aggregated. Typically, there are less then ten branches for industry, the residential and commercial sectors might be completely aggregated, and the internal transport is only split between road, rail, water and air transport.

In EPM, the sector disaggregation level is much higher. Therefore, the energy consumption of the main sectors is disaggregated by sub-sector. For each of the main sub-sectors, the consumption is calculated by multiplying an activity variable by a specific consumption. This is done separately for two categories of energy carriers (fuels, electricity). The balance, calculated by difference, corresponds to a “balance” sub-sector.

In this way, the total energy consumption by sector remains consistent with the energy statistics. It should be noted that in the projections, the impact of any inaccuracy on the activity variable or specific consumption of a sub-sector is only of the second order.

For each sub-sector, the consumption by type of fuel is obtained by multiplying the total consumption for fuels by the “market share” of each fuel. The latter is based on the fuel market shares for the sector as a whole and any additional relevant data for the sub-sector.

Emissions linked to fuel consumptions are obtained by multiplying the fuel consumptions with an emission factor expressed by unit of energy consumption. Process emissions are calculated by multiplying the activity variable of the sub-sector by a process emission factor.

Projection

The energy consumption of each sub-sector is first aggregated by category of energy carrier. The evolutions of the activity variables and of the specific energy consumptions which are then applied are exogenous. They are specified as an average annual rate of increase by periods of any number of years. Future fuel market shares are also exogenous. For each sub-sector, the default fuel market shares are those of the reference year.

The evolution of the specific consumptions allows taking into account both the technical progress and the renewal of existing equipments, which lead in a natural way to a decrease of the specific consumptions, even in the absence of any particular policy. It is also used for taking into account the increased electricity consumption linked to the extension of new applications of electricity (atomization, electronic office equipment…). Exogenous evolutions of (fuel or process) emission factors are also allowed, so as to take into account any emission reductions due to any decisions already made.

Reduction potential

Energy saving measures are often linked to a particular type of energy use (heating, pumps, ventilators, refrigeration, lighting…). Therefore, before calculating the reduction potential, energy consumptions are distributed by type of energy use, on the basis of percentage distributions by sub-sector. In practice this is especially useful for electrical energy consumption in industry and the residential and commercial sectors. For CO2, about a hundred measures are taken into account in the model, which may be specific to one or more sectors, to one or more energy uses or generic. These measures can be classified in the following categories: energy saving, cogeneration, renewable energy and fuel substitution. Each measure is characterized by several techno-economic parameters (energy saving rate, existing penetration rate, technical maximum penetration rate, economic lifetime, specific investment cost, specific operation & maintenance cost). For each measure, the model calculates a specific energy saving or emission reduction cost, as the sum of the annualized investment cost and the annual O&M cost, minus the value of the energy saving made, divided by the yearly energy saving or emission reduction level.

This set of data allows to calculate two types of reduction potentials:
- a technical reduction potential;
- an "economic" reduction potential.

The ***technical potential*** corresponds to the maximum implementation of all reduction measures, while the ***economic potential*** corresponds to the fraction of the technical potential for which the unit cost is below a given ceiling.

Cost dispersion

In practice, the unit cost of a reduction measure generally appears to differ from one site to another, for a variety of reasons: the price of equipment, the capacity utilization factor, the installation costs, the O&M costs, the efficiency of the equipment may all vary from one case to another.
It is therefore little realistic to assume that each reduction measure has a unique cost per unit of energy of pollutant, and to consider that this measure would be applied either 0% or 100% according to whether this cost falls above or below a given unit cost ceiling.
For this reason, in EPM a dispersion around the mean value is introduced on the unit cost of each reduction measure, following a given probability law. This dispersion is characterised by the ratio of standard deviation/mean (σ /m). For each measure, this distribution allows to calculate the fraction of the maximum potential which is economic, i.e. below the appropriate. The model also allows to draw "cost curves". They are a simplified way of representing the economic reduction potential (they don't take into the cost dispersion just mentioned).
Such curves are obtained by ranking the reduction measures by increasing unit cost and plotting either the unit cost or the cumulated total cost as a function of the cumulated emission reduction. This produces either a "marginal cost curve" or a "total cost curve".

III. Environment Brussels Energy Emissions Projections Model

The Brussels Institute for Environmental Management has developed its own projection model for energy demand and atmospheric emissions from stationary sources (residential, tertiary, industry and energy sector).

As bottom-up type model, changes in consumption of the several energy carriers used in the Brussels-Capital Region (natural gas, light oil, propane/butane, coal, electricity, wood, solar and heat pump) and their associated emissions (CO_2, CH_4, N_2O, NO_x, CO, NMVOC, SO_x, NH_3, PM) are determined by the evolution of parameters that define the consumption of each sector.

For example, the residential sector is defined by the following main parameters :
- population and average household size (those 2 parameters define the net requirement for new dwellings)

- climate (expressed in degree-days, this parameter is of great importance for the Brussels-Capital Region, as it reflects the need for heating of buildings which represents about 70% of regional GHG direct emissions)
- demolition and renovation rate, improvement of energy efficiency expected in case of renovation. This improvement depends on on the typology of building stock composed of 244 type-dwellings : apartment or house, 4 age range of the building concerned, the 7 energy carrier used for heating, the heating system installed (central or decentralised), and as is occupied by the owner or tenant

The model has been calibrated for each sector with the regional annual energy balances from 2000 to 2006.
The modelled energy consumptions have then been converted into atmospheric emissions through emission factors, the ones used to establish the emission inventories which are also required by Decision 280/2004/EC - monitoring mechanism.

The model also takes into account the GHG direct emissions that are not related to energy consumption :i.e. the fugitive methane emissions of natural gas delivery, the use of N_2O for anaesthesia, the emissions from the decomposition of organic matter (composting plant, water purification plant).
NB : The fluorinated gases need a very specific approach which is here defined at national level.

This model is a dynamic one. It allows new future available data to be integrated (for instance future Energy balances) as well as new assumptions reflecting new studies and new phenomena (in the fields of regulation, technological change, through awareness campaigns, incentives, or the evolution of energy costs, …). It can also be extended beyond 2020.

IV. TREMOVE : ECONOMIC TRANSPORT AND EMISSIONS MODEL

TREMOVE is a transport and emissions simulation model developed for the European Commission[10]. It
is designed to study the effects of different transport and environment policies on the emissions of the transport sector. The model estimates the transport demand, the modal split, the vehicle fleets, the emissions
of air pollutants and the welfare level under different policy scenarios. All relevant transport modes are modelled, including air transport. Maritime transport is treated in a separate model

The first of the TREMOVE model was developed in 1997-1998 by K.U.Leuven and DRI as an analytical underpinning for the second European Auto-Oil programme. Since 2002, Transport & Mobility Leuven is further developing the model for DG ENV. In 2006-2007, the model has been extended to 31 countries (EU-27 plus Croatia, Norway, Switzerland and Turkey) and to the time horizon 2030. Also planned are improvements in the vehicle choice module and the transport module.
Parallel to the European model, Transport & Mobility Leuven has also developed a Belgian and a Flemish version.

In 2008, two projects related to TREMOVE data have been completed. “European Database of Vehicle Stock for the Calculation and Forecast of Pollutant and Greenhouse Gases Emissions with TREMOVE and COPERT” is available on the website http://lat.eng.auth.gr/copert/ in section "data". Information on non-road transport activity data can be found in the web-site of the Ex-Tremis project (EXploring non-road TRansport EMISsions in Europe) http://www.ex-tremis.eu.

[10] Link to the TREMOVE page on the Europa website:
http://ec.europa.eu/environment/air/pollutants/models/tremove.htm

V. Description of the HERMES-model

Figure 1 gives a general simplified flowchart of the complete model while Table 9 summarizes the main characteristics and subdivisions of HERMES.

HERMES is the macrosectoral model used by the Belgian Federal Planning Bureau for its national short and medium term forecasts[11]. The model is also used for making variant analysis. The simulation period varies from 1 to 12 years, depending on the exercise. HERMES fits in the tradition of annual econometric models based on time series analysis. Since disaggregation is a key feature of the model, it is possible to describe shifts among the different sectors or branches; it also allows the various effects of measures or external shocks on separate branches to show up.

HERMES is a medium-term demand oriented model in which supply elements play an important role. The activity of the branches is determined mainly through the demand side. Production capacity is also demand determined in the long run, although supply effects are present. Contrary to technological models, HERMES does not explicitly integrate a description of the different technologies of production. Adjustment of production to existing capacity plays a role in the explanation of prices, investments and imports. HERMES incorporates fundamental neoclassical mechanisms for the determination of the marginal technical coefficients, the explanation of investment and the computation of capacities. Supply side effects are also incorporated in export equations. Technological progress is exogenously included in the production functions.

Starting from internal and external demand, the model computes the marginal profitability of production capacity. For this purpose, it calculates the optimal allocation of the branches' resources between the different production factors (capital, labour, energy and other intermediary inputs) on the basis of anticipated factor prices. Production costs constitute the main determinant of prices in HERMES. Other determinants in the short run are capacity utilization rates in each branch. Once demand on the various markets and prices have been computed the model allocates total resources between the different agents and computes their disposable income, taking into account taxes and social contributions paid to the State and social transfers received by each of them.

The current version of HERMES contains about 4500 equations (of which 450 behavioural equations) and more than 700 exogenous variables. The model's size is mainly a consequence of breaking down the economy in 16 branches. HERMES also distinguishes five different institutional sectors: households, non-profit institutions serving households, corporate enterprises (regrouping non-financial and financial corporate enterprises), public administrations (split themselves into four entities: federal government, regions and communities, local authorities and social security) and the rest of the world. Developments within - as well as interactions between - the different institutional sectors and activity branches have been extensively modelled, using the input-output data. The model's size is also a consequence of the high level of disaggregation of the consumption module. The total consumption budget is allocated to 15 main categories of consumption, some of these categories being themselves disaggregated. This gives at the highest level of disaggregation 24 consumption categories. The energy module is also very detailed. Aggregate energy demand of each economic agent (firms, government,

[11] These forecasts can be found in "Perspectives économiques 2008-2013", May 2008. More information about the HERMES model can be found in "Une nouvelle version du modèle HERMES", Février 2004. Both those publications are downloadable from the FPB's website (www.plan.be).

households) is computed and allocated between 8 energy products; energy production is also modelled.

Energy products play a dual role in the HERMES model as production factors in the production function for each branch and as a production branch itself. For each of the eight energy products, demand, prices and an input-output equilibrium, in quantity and in value terms are calculated. The latter leads to a central application of the energy module in the model: the compilation of annual physical energy balance sheets according to the EC format from which, in turn, can be derived GHG emission sheets. To link the various forms of energy consumption and the emission of air pollutants, technical relations are specified. The analysis of the substitution behaviour between energy products takes a central place in the model. Total energy demand of each industrial branch is computed with demand functions derived from two-level CD-CES production functions, in which energy is supposed to be weakly separable from the other inputs. At a second stage, expenditure on energy is broken down into expenditures in the different energy products. To this end, we use a unit energy cost function, without imposing a priori restrictions on the structure of demand.

The database is updated annually. The data are culled primarily from the National Accounts. Over the past few years, the model has been practically under continuous review. This constant review is the result not only of renewed specifications or extensions of the model but also of the new national account system ESR95, any possible reappraisals of the time series, new input-output information,...

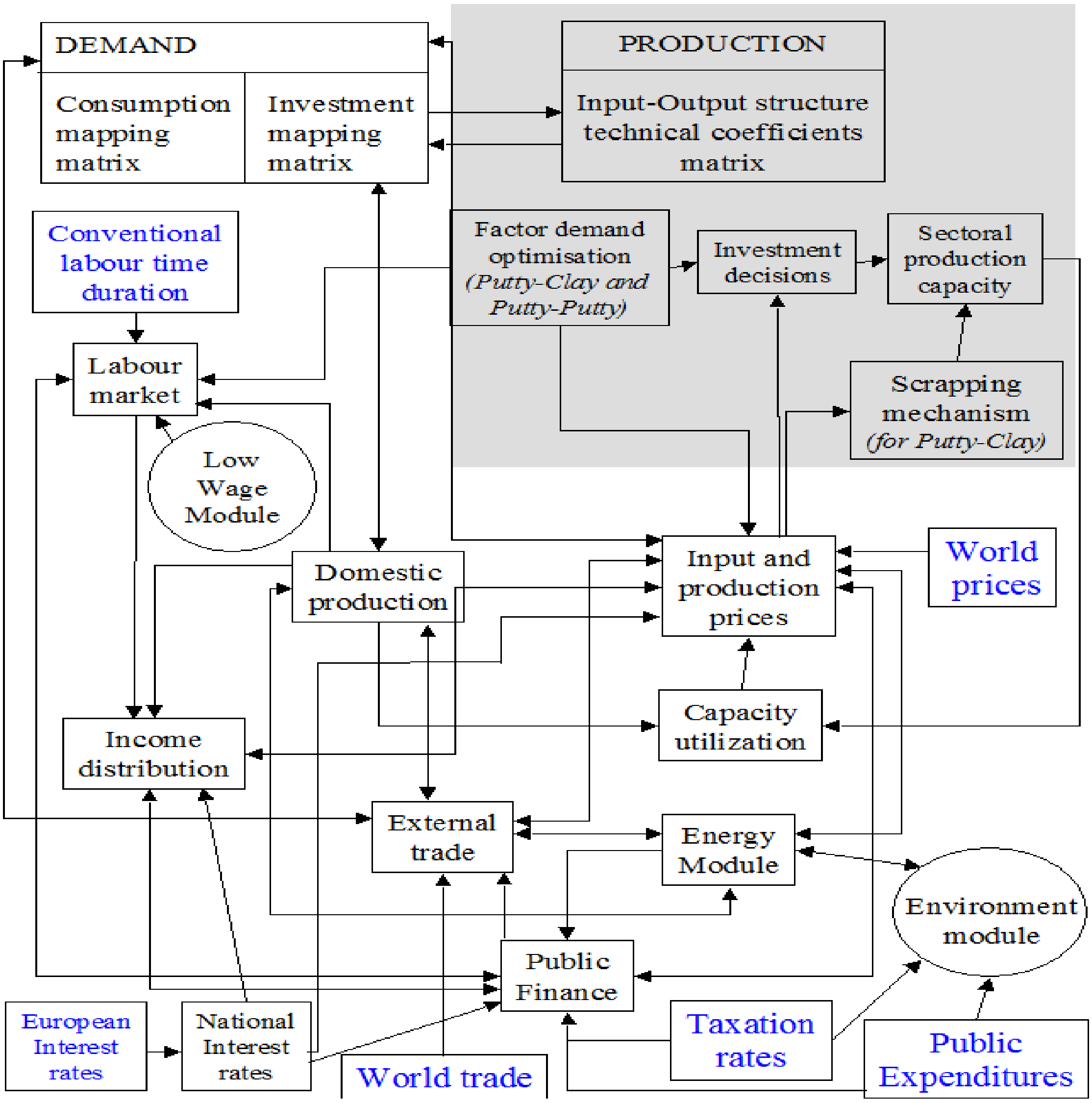

Figure Annex 1: A flowchart of HERMES

Table Annex 1: Main characteristics and subdivisions of HERMES

General characteristics	
- 4500 equations (of which 450 behavioural equations)	
- 700 exogenous variables	
- 4 production factors: labour, capital, energy, other intermediary goods and services	
- 16 branches	
- 15 main consumption categories, 24 in total	
- 8 energy products	
Branches	Consumption categories
Agriculture	Food, drinks and tobacco
Energy	- food
Intermediary goods	- non-alcoholic beverages
Equipment goods	- alcoholic beverages
Consumption goods	- tobacco
Construction	Clothing and footwear
Transport and communications	Gross rent
- Railroad transport	Fuel for heating
- Urban and road transport	- coal
- Water and air transport	- petroleum products
- Auxiliary transport activities and communication	- gas
Trade, lodging and catering services	Power
Credit and insurance	Domestic services
Health care	Furniture and household equipment
Other market services to households and firms	Personal transport equipment
General government services	Operation of personal transport equipment
Other non-market services	- petrol
	- diesel
	- other
	Transport services[12]
	Communication services
	Medical care and health service
	Recreation, education, culture
	Other goods and services
	Tourism abroad
Energy products and environment	Institutional sectors
- Coal	- Households
- Coke	- Non-profit institutions serving households (NPISH)
- Crude oil	- Corporate enterprises

[12] This consumption category is itself disaggregated into three sub-categories: passenger transport by train, tram and underground; passenger transport by road and other transport services.

- Petroleum products	. Non-financial corporate enterprises
- Natural gas	. Credit institutions and insurance enterprises
- Derived gases	- General government
- Electricity	. Federal government
- Renewables	. Regions and Communities
	. Local authorities
GHG emissions: CO_2, CH_4, N_2O, HFCs, PFCs and SF_6	. Social security fund
	- Rest of the world

VI DESCRIPTION OF THE PRIMES-MODEL

The PRIMES model was developed under the research projects funded by the European Commission Joule programme. The design was influenced by the previous generation of energy models (EFOM, MIDAS and MEDEE). The PRIMES model was developed to make energy projections, draft scenarios and analyse the impact of energy policy measures. This is a partial equilibrium model because it only covers the energy system and not the rest of the economy. The PRIMES model can be used to simulate trends in supply, demand, prices and emissions of pollutants for the various fuels, taking account of the fact that international energy prices and macroeconomic variables (GDP, disposable income, inflation, interest rates and so forth) are incorporated exogenously. In the PRIMES model, changes in the energy supply and prices and limits for the emission of pollutants cannot in turn influence the economic sphere. PRIMES is a market-driven model which simultaneously simulates a balance between supply and demand both at European level and for the 15 countries individually. Equilibrium is reached when prices ensure a balance between demand and supply for the different forms of energy. Convergence towards equilibrium occurs iteratively. Based on an estimate of the prices for the various forms of energy, PRIMES provides an initial estimate of demand. This determines the requisite capacity and level of the various forms of energy. The choice of production technology is then determined endogenously on a "least production costs" basis. PRIMES calculates the production costs which, after duties are added, provide an initial estimate of consumption prices. Prices are then compared to the previous iteration and the convergence process terminates once they are sufficiently close. If not, a fresh estimate of demand is made and the back coupling process continues.

Demand comprises a series of non-linear equations. The model for final energy demand for energy is based on a bottom-up approach (engineering approach), but includes a minimisation of energy users' costs. The model uses a very precise sector breakdown, allowing for 24 different energy forms. The model distinguishes between 9 branches of activity in the industrial sector. Each segment is broken down into different subsectors (some 30 subsectors in all, including recycling); at the subsector level, various kinds of energy use are distinguished according to the production process (blast-furnaces, electrical furnaces, electrolysis, etc.). For the residential sector, 5 different types of buildings are distinguished according to the heating system used (central heating, partial central heating, electric heating, district heating and independent gas heating). In addition to the type of heating, the model also considers three other kinds of household energy use: hot water, cooking and specific electricity use. Household demand depends on different variables, including disposable household income, the number of degree-days, the type of heating system, and parameters that reflect the technology and features of the house insulation. Within the tertiary sector, a distinction is made between the commercial sector, the non-market sector and trade services. Various types of energy use are considered, according to the technology used. The model also considers energy consumption for the agricultural sector separately. PRIMES distinguishes between passenger and freight transport. Four means of transport are considered – air, rail, road and sea. For road passenger transport, a distinction is

made between public transport (buses) and private transport (cars and motorcycles). Between six and ten different technologies are considered for cars, lorries and buses. A lesser number of technologies are considered for rail, air and sea transport. The total transport volume is determined by the growth in income and GDP. The distribution among the various forms of transport depends on their relative prices, which are in turn influenced by the technology of new investments and the existing fleet.

The energy supply in PRIMES consists primarily of three modules for electricity and steam generation, oil refining and other transformation sectors. To accommodate the demand curves, the module for electricity and steam generation determines the choice of the production processes, the extension and decommissioning of the required means of production and the choice of fuel. The model takes account of a large number of technologies for electricity production (by combining the various technologies, fuels, sizes and forms, a choice of more than 900 power stations is possible). Particular attention is focused on the combined heat and power production, renewable energy sources and new forms of energy. Refineries operate nationally, but capacity, market share and prices are determined by competition at European level. For primary energy, the model determines the optimum share of imports and domestic production to be able to meet demand. The model considers the global petroleum market as being exogenous.

A key feature of the model is a tariff module ensuring a balance between demand and supply. This module calculates the revenue that the sector requires (on the basis of total expenses and other accounting expenses) and allocates charges to users in accordance with the Ramsey pricing principle. The consumer price is then deduced by totalling the distribution and transport costs, margins and duties.

Section 3.
Information on the use of joint implementation, the clean development mechanism and international emissions trading

Reporting under Article 3(2)(a)(vi) and Article 3(2)(d) of Decision 280/2004/EC

Information on the use of joint implementation, the clean development mechanism and international emissions trading

<u>Preliminary remark :</u>

The information on the intended use by Belgium of joint implementation, the clean development mechanism and international emissions trading, pursuant to Articles 6, 12 and 17 of the Kyoto Protocol, is reported here on the basis of the questionnaire set out in Annex V to the Commission decision of 14 February 2005 laying down rules implementing Decision 280/2004/EC.

Questionnaire on the use of the Kyoto Protocol mechanisms in meeting the 2008-2012 targets

Answer of Belgium

15 March 2009

1. Does your Member State intend to use joint implementation (JI), the clean development mechanism (CDM) and international emissions trading (IET) under the Kyoto Protocol (the Kyoto mechanisms) to meet its quantified emission limitation or reduction commitment pursuant to Article 2 of Decision 2002/358/EC and the Kyoto Protocol? If so, what progress has been made with the implementing provisions (operational programmes, institutionaldecisions) and any related domestic legislation?

- In general for Belgium:
Yes, Belgium will use the mechanisms in order to fulfil its emission reduction commitment. Therefore, the National Commission on Climate (Commission nationale Climat) has been designated to be the Belgian "DNA" (Designated national authority) and Focal Point. This political decision has been transposed in Belgian national law by a cooperation agreement between the federal government and the three regional governments. This cooperation agreement includes both the official designation of the DNA and Focal Point, as well as the transposition of Directive 2004/101/CE and of some Kyoto rules related to the use of the mechanisms (eligibility requirement, commitment period reserve, banking, limits on sinks credits, etc.). See also question 2.

- In particular for the federal Government:
In addition to the legal procedure described above, the federal Government launched a first tender for JI and CDM projects in May 2005, with an initial budget of 10 millions Euros. In October 2006 an additional budget of 3 million euros was allocated to the first tender. Moreover, the federal Council of Ministers approved on February 24th 2006 a additional budget of 50 millions Euros for new initiatives for the acquisition of Emission Reductions from JI and CDM project activities, both through a second JI/CDM Tender and through investments in multilateral carbon Funds. On February 16th 2007 the Council of Ministers further decided both to invest 25 millions Euros of this budget in the KfW Carbon Fund and to invest minimum 22 millions euros in the Second JI/CDM Tender, which was launched by mid March 2007. The contract with KfW Carbon Fund was finalized by mid 2008. The next purchase initiative of the federal Government, following a decision of the Council of Ministers of June 27th 2008, was to invest in the "Green Investment Scheme (GIS)" Programme of Hungary. This agreement was finalized by mid 2008 and involved the purchase of emission rights, while the revenues from the sale of these emission rights have to be used by the Hungarian government to finance energy efficiency projects in both private and public buildings and renewable energy projects. Finally, the Council of Ministers of decided in its decision of May 9th 2008 to reserve a budget of 50 million Euros for a third JI/CDM tender. The official documents of this tender were approved on December 19th 2008 and the tender itself was launched on January 15th 2009.

- In the Brussels Capital Region, the legal base is the ordonnance of 1 January 2008 founding a scheme for GHG allowance trading and relating to the mechanisms of flexibility of the Protocol of Kyoto. The Brussels Capital Region is using the Clean Development Mechanism (CDM) through the Community Development Carbon Fund of the World Bank. The regional Government has decided in November 2004 to invest 9,5 million US$, between 2005 to 2014. This investment should provide to the Region about 500.000t CO_{2eq} in CER for the 1st commitment period.

- In order to meet its Kyoto commitments, the flemish Region foresees the acquisition and use of Kyoto units from the Kyoto flexible mechanisms. The legal basis for the use of the flexible mechanisms is foreseen in the so called 'REG-decree', which was adopted by the flemish Parliament on April 2nd 2004. A decision of the flemish government on the flexible mechanisms, based on the

legal provisions of the REG-decree, has been approved on January 12th 2007. This decision defines the flemish approval procedures for project activities, together with the acquisition procedures for both private entities as well as the flemish Government itself.

- In the walloon Region, the legal base is the decree of 10 November 2004 founding a scheme for GHG allowance trading, creating Kyoto Funds and relating to the mechanisms of flexibility of the Protocol of Kyoto. In this decree, it is envisaged the creation of a walloon "Kyoto" fund whose receipts can be assigned to the realization of project mechanisms (CDM or JI) or for the purchase of emission credits (International Emissions Trading). On23 December 2004, the walloon Government approved its participation in the CDCF of the World Bank with a financing of 5 million US$.

2. Has your Member State established and notified to the UNFCCC a designated national authority for clean development mechanism projects and a designated focal point for joint implementation projects? If so, please provide details.

On March 8th 2007, Belgium has notified the UNFCCC that his National Climate Commission had been legally designated as national Focal Point and Designated National Authority for JI- and CDM-project activities approval. This was provided for by the cooperation agreement that the regions and the federal governments signed on 19 February 2007.
The cooperation agreement entered into force on March 26th 2007 after approval by each one of the 4 federate assemblies (by the federal parliament and by the parliaments of the three regions).

The approval procedures of the competent authorities have been published on the website of the National Climate Commission (http://klimaatplan.vito.be/KLIMAATPLAN/EN/Home/Focalpoint/).

3. Which of the three Kyoto mechanisms is your Member State using or does it plan to use?

(1) - Federal Government: The objective of the federal Government is to purchase in priority credits from JI and CDM projects. Therefore, a first tender for JI and CDM was launched in May 2005 with an initial budget of 10 millions Euros. In October 2006 an additional budget of 3 million euros was allocated to the first tender. Furthermore: (1) the federal Government has decided on 16 February 2007 to invest 25 millions Euros in the KfW Carbon Fund and (2) a second JI/CDM Tender was launched by mid-march 2007 with a budget of 22 millions Euros, and (3) a third JI/CDM Tender was launched by mid-January 2009 with a budget of 50 millions Euros. Finally, the purchase of credits through the International Emissions Trading (IET) was only an option from 2008 onwards (as defined through the internal burden sharing agreement). In this context, the federal Government concluded a GIS agreement with Hungary in mid 2008.

- The Brussels-Capital Region intends to use only the Clean Development Mechanism (CDM).

- The decision of the flemish Government on the use of the flexible mechanisms of the Kyoto Protocol defines the flemish acquisition strategy. In first instance, the flemish Region will make use of the project-based flexible mechanisms (CDM and JI) and will acquire Kyoto-units which arise from a known or tested investment or project activity. From 2008, the flemish Region can also proceed to the direct purchase of project-related Kyoto-units on the international market. If it becomes clear that the budgets which are provided, are not sufficient to make up the remaining gap in reductions, other acquisition channels with a probably lower cost price could also be used in last instance.

- Walloon Region: As explained in the first question, we intend to use all the flexible mechanisms. Nowthe walloon Region only uses the CDM (through the CDCF) but if we need to buy more credits, we could consider all the flexible mechanisms.

4. What quantitative contributions to the fulfilment of the quantified emission limitation or reduction commitment pursuant to Article 2 of Decision 2002/358/EC and the Kyoto Protocol does your Member State expect from the Kyoto mechanisms during the first quantified emission limitation and reduction commitment period, from 2008 to 2012 (please use Table 1)?

TABLE 1
Quantitative contribution of Kyoto mechanisms for the first commitment period

Kyoto mechanism	Total projected quantities for the first commitment period (Gg CO2 equivalent)
Total for all Kyoto mechanisms (*)	Brussels-Capital Region: 500.000t CO_2.eq. Flemish Region: In drawing up the Progress Report 2008 of the Flemish Climate Policy Plan 2006-2012, the remaining reduction effort was estimated at 8,9 Mton CO_2-eq for the period 2008-2012. The acquisition objective will be periodically evaluated taking into account the most up-to-date projections of Flemish greenhouse gas emissions in the Kyoto-period and the reduction potential of internal policy measures. Walloon Region: 0,5 Mton CO_2-éq Federal level: 12,2 Mton CO_2-eq (with a priority and a preference given to project based activities)
International emissions trading	
All project based activities	
joint implementation	
clean development mechanism	Brussels-Capital Region*: 500.000t CO_2.eq.* Walloon Region: 0,5 Mton CO_2-éq

(*) If possible please disaggregate this data as suggested in *Italics*.

5. Specify the budget in euro for the total use of the Kyoto mechanisms and, where possible, per mechanism and initiative, programme or fund, including the time over which the budget will be spent.

- Federal Government: A “Kyoto Fund” was established in 2004, with a budget of 25 millions Euros/year, mainly dedicated to the buying of Kyoto units. As a first step, a federal JI/CDM tender was launched in May 2005, with an initial budget of 10 millions Euros. In October 2006 an additional budget of 3 million euros was allocated to the first tender. Moreover, the federal Council of Ministers decided on 16 February 2007 to launch a second JI/CDM Tender with a budget of 22 millions EUR (this Tender was launched in mid-March 2007) and to invest 25 millions EUR in the KfW Carbon Fund. The Council of Ministers of 27 June 2008 decided to foresee a budget of 30 million Euros for investment in a GIS, which eventually led to an agreement with Hungary in mid 2008. Finally, a third JI/CDM Tender was launched on 15 January 2009 with a budget of 50 million Euros, to which additional funds may be released at the Federal Government’s own discretion

- The Government of the Brussels Capital Region has decided in November 2004 to invest 9,5 million US$, between 2005 to 2014.

- The first appeal to companies was launched to submit project proposals related to JI and CDM. One proposal has been selected definitively. The flemish Region will purchase CERs from two landfill gas projects in Chile. The emission reduction purchase agreement has been signed on December 13th 2006. A second channel used by the flemish Region to acquire Kyoto-units concerns climate funds. On 20 October 2006 the flemish Government approved a decision to join the Multilateral Carbon Credit Fund (MCCF), via the Flanders Participation Company (PMV). This is a joint initiative of the European Bank for Reconstruction and Development (EBRD) and the European Investment Bank (EIB). The flemish Region will invest 22 million euros in the MCCF.
The participation of the flemish Region in the Worldbank/European Investment Bank Carbon Fund for Europe (first tranche) has been approved by a decision of theflemish Government on the 8th of December 2006. The flemish Region will invest 10 million euros in this fund.
On 22 June 2007 the flemish Government approved a decision to join the Asian Pacific Carbon Fund (APCF), via the PMV. The APCF is a initiative of the Asian Development Bank (ADB). The flemish Region invests 20 million euros in the APCF.
On 19 July 2007 the flemish Government approved the investment in a small scale reforestation project in Bolivia.

– The walloon Region is a participant of the CDCF of the Worldbank. The financial contribution for the Region is 5 million of US$. By the end of 2006, the walloon Region has already paid around 4 millions euros. (2 millions in 2005 and 2006).

6. With which countries has your Member State closed bilateral or multilateral agreements, or agreed memorandums of understanding or contracts for the implementation of project based activities?

- A cooperation agreement on the clean development mechanism between China and Belgium has been concluded on September 22th 2006.

- Federal Government: None

- Brussels Capital Region: Concerning the CDCF, the information of the different projects implemented in this fund are available on the web site : http://carbonfinance.org/

- Cooperation within the objective of the UN Framework Convention on Climate Change and its Kyoto Protocol, in particular in the field of Joint Implementation under Article 6 and/or in the field of Emissions Trading under Article 17 of the Kyoto Protocol, has been integrated in cooperation programmes between the flemish Government and different European countries. These cooperation programmes have been listed in the following table.

Country	**Date of signing**	**Duration**
Bulgaria	15/11/2006	2007-2008
Romania	28/11/2007	2008-2009
Czech Republic	23/05/2008	2008-2010
Latvia	28/05/2008	2008-2011
Poland	13/06/2008	2009-2011
Slovakia	01/07/2008	2008-2010

Estonia	15/10/2008	2009-2011
Croatia	23/10/2008	2009-2010
Slovenia	20/11/2008	2009-2011
Bulgaria *	03/04/2009	2009-?
Lithuania *	22/04/2009	2009-?
Hungary *	20/05/2009	2009-?

* in preparation

- Walloon Region: Concerning the CDCF, the information of the different projects implemented in this fund are available on the web site : http://carbonfinance.org/

In 2007, the walloon Region will ask the Belgian DNA to approve the LoA of 9 projects included in the CDCF.

Fund Participant	**Walloon Region**
Projects **CDCF Portfolio** 1. Argentina - Olavarría Landfill Gas Recovery Project - Project 0140 http://cdm.unfccc.int/Projects/DB/DNV-CUK1133527193.57/view.html 2. Honduras - La Esperanza Hydroelectric Project - Project 0009 http://cdm.unfccc.int/Projects/DB/DNV-CUK1098894708.4/view.html 3. India - Vertical Shaft Brick Kiln Cluster Project - Project 0582 http://cdm.unfccc.int/Projects/DB/DNV-CUK1157015776.99/view.html 4. Moldova - Biomass Heating in Rural Communities (Project Design Document No.1) - Project 0159 http://cdm.unfccc.int/Projects/DB/DNV-CUK1133985182.37/view.html 5. Moldova - Biomass Heating in Rural Communities (Project Design Document No. 2) - Project 0160 http://cdm.unfccc.int/Projects/DB/DNV-CUK1133985755.59/view.html 6. Moldova - Energy Conservation and Greenhouse Gases Emissions Reduction - Project 0173 http://cdm.unfccc.int/Projects/DB/DNV-CUK1134568842.81/view.html 7. Nepal - Biogas Support Program (BSP-Nepal) Activity-1 - Project 0136 http://cdm.unfccc.int/Projects/DB/DNV-CUK1132666829.52/view.html 8. Nepal - Biogas Support Program - Nepal (BSP-Nepal) Activity-2 - Project 0139 http://cdm.unfccc.int/Projects/DB/DNV-CUK1132671435.09/view.html 9. Peru - Santa Rosa - Project 0088 http://cdm.unfccc.int/Projects/DB/SGS-UKL1125047848.33/view.html	

7. For each planned, ongoing and completed clean development mechanism and joint implementation project activity in which your Member State participates, provide the following information:

- Federal Government:

1) An ERPA was signed between the federal Government and LaGeo S.A. de C.V.

   (a) Project title and category (JI/CDM): "Berlin Binary Cycle Power Plant" – CDM project.

   (b) Host country: El Salvador

   (c) Financing: private

   (d) Project type: renewable energy generation

   (e) Status: in operation since 2007

   (f) Lifetime:

   - date of official approval (e.g. of the Executive Board for clean development mechanism projects, of the host country for joint implementation projects): 30 November 2007;
   - Date of project initiation (operation starts): Fully operational since June 2008;
   - Expected date of project termination (lifetime): 30 years;
   - Crediting period (for what years will ERUs or CERs be generated): 7 years (renewable), starting in 2007;
   - Date(s) of issue of emission reduction units (ERUs)(by host country) or certified emission reductions (CERs)(by CDM executive board): Each year from 1 April 2008 until 1 April 2013

   (g) First or second track approval procedure (For joint implementation projects only): -

   (h) Projected total and annual emissions reductions that accrue until the end of the first commitment period: 44.141 t CO2eq/year (except during the first year) or 261.097 tCO2 eq. until 2012.

   (i) Amount of CERS generated by the projects that will be acquired by the Member State: between 70 and 100% of the amount generated by the project (confidential information).

   (j) Credits accrued until the end of reporting year: provide information on the number of credits (total and annual) obtained from joint implementation projects, clean development projects and credits resulting from land use, land use change and forestry activities: 44.141 t CO2eq. should be generated in 2009.

2) Two ERPA's were signed between the federal Government and Wincono Cyprus Ltd.

   (a) Project title and category (JI/CDM): "Alexigros Wind Farm Project and Mari Wind Farm Project" – both CDM projects.

   (b) Host country: Cyprus

   (c) Financing: private

(d) Project type: renewable energy generation

(e) Status: under construction (start-up or construction phase)

(f) Lifetime:

- date of official approval (e.g. of the Executive Board for clean development mechanism projects, of the host country for joint implementation projects): 28 December 2006 & 21 December 2006;
- Date of project initiation (operation starts): assumed commissioning of the Alexigros project by the end of 2009, assumed commissioning of the Mari project by the end of 2008
- Expected date of project termination (lifetime): 21 years (in both cases);
- Crediting period (for what years will ERUs or CERs be generated): respectively 7 years (renewable) starting in 2008 and 7 years (renewable) starting in 2007;
- Date(s) of issue of emission reduction units (ERUs)(by host country) or certified emission reductions (CERs)(by CDM executive board): respectively each year from 1 April 2011 until 1 April 2013, and each year from 1 April 2010 until 1 April 2013

(g) First or second track approval procedure (For joint implementation projects only): -

(h) Projected total and annual emissions reductions that accrue until the end of the first commitment period: respectively 58.722 t CO2eq/year or 176.166 tCO2 eq. until 2012 for the Alexigros project, and 16.395 t CO2eq/year or 65.580 t CO2 eq. until 2012 for the Mari project.

(i) Amount of CERS generated by the projects that will be acquired by the Member State: respectively 100% and 90 % of the amount generated by the projects.

(j) Credits accrued until the end of reporting year: provide information on the number of credits (total and annual) obtained from joint implementation projects, clean development projects and credits resulting from land use, land use change and forestry activities: none in both cases.

3) An ERPA was signed between the federal Government and Yash Papers Limited.

(a) Project title and category (JI/CDM): “Biomass based Cogeneration power project in Uttar Pradesh” – CDM project.

(b) Host country: India

(c) Financing: private

(d) Project type: renewable energy generation (biomass)

(e) Status: in operation since 26/03/2007

(f) Lifetime:

- date of official approval (e.g. of the Executive Board for clean development mechanism projects, of the host country for joint implementation projects): 1 April 2007;
- Date of project initiation (operation starts): March 2007;
- Expected date of project termination (lifetime): 30 years;
- Crediting period (for what years will ERUs or CERs be generated): 7 years (renewable) starting in 2007;

- Date(s) of issue of emission reduction units (ERUs)(by host country) or certified emission reductions (CERs)(by CDM executive board): not determined

(g) First or second track approval procedure (For joint implementation projects only): -

(h) Projected total and annual emissions reductions that accrue until the end of the first commitment period: 33.422 t CO2eq/year or 233.951 tCO2 eq. until 2012.

(i) Amount of CERS generated by the projects that will be acquired by the Member State: 100% of the amount generated by the project (confidential information), but non-guaranteed.

(j) Credits accrued until the end of reporting year: provide information on the number of credits (total and annual) obtained from joint implementation projects, clean development projects and credits resulting from land use, land use change and forestry activities: 33.422 t CO2eq. should be generated in 2009, but non-guaranteed.

4) An ERPA was signed between the federal Government and Industrias del Espino S.A.

(a) Project title and category (JI/CDM): "Palmas del Espino – Biogas recovery and heat generation from Palm Oil Mill Effluent (POME) ponds" – CDM project.

(b) Host country: Peru

(c) Financing: private

(d) Project type: waste management and renewable energy generation

(e) Status: in operation

(f) Lifetime:

- date of official approval (e.g. of the Executive Board for clean development mechanism projects, of the host country for joint implementation projects): not yet available
- Date of project initiation (operation starts): July 2007;
- Expected date of project termination (lifetime): 25 years;
- Crediting period (for what years will ERUs or CERs be generated): 7 years (renewable) starting in 2007;
- Date(s) of issue of emission reduction units (ERUs)(by host country) or certified emission reductions (CERs)(by CDM executive board): Each year from 1 April 2009 until 1 April 2013

(g) First or second track approval procedure (For joint implementation projects only): -

(h) Projected total and annual emissions reductions that accrue until the end of the first commitment period: 23.370 t CO2eq/year or 140.219 tCO2 eq. until 2012.

(i) Amount of CERS generated by the projects that will be acquired by the Member State: 100% of the amount generated by the project, except for the first year.

(j) Credits accrued until the end of reporting year: provide information on the number of credits (total and annual) obtained from joint implementation projects, clean development projects and credits resulting from land use, land use change and forestry activities: 21.000 t CO2eq. should be generated in 2009

5) An ERPA was signed between the federal Government and Shree Bhawani Paper Mills Limited

(a) Project title and category (JI/CDM): “Rice husk based cogeneration power plant-II at SBPML” – CDM project.

(b) Host country: India

(c) Financing: private

(d) Project type: waste management and renewable energy generation

(e) Status: in operation

(f) Lifetime:

- date of official approval (e.g. of the Executive Board for clean development mechanism projects, of the host country for joint implementation projects): 15 January 2007
- Date of project initiation (operation starts): February 2006
- Expected date of project termination (lifetime): 25 years;
- Crediting period (for what years will ERUs or CERs be generated): 10 years (fixed) starting in January 2007;
- Date(s) of issue of emission reduction units (ERUs)(by host country) or certified emission reductions (CERs)(by CDM executive board): Each year from 1 July 2009 until 1 July 2013

(g) First or second track approval procedure (For joint implementation projects only): -

(h) Projected total and annual emissions reductions that accrue until the end of the first commitment period: 13 993 t CO2eq/year or 71 000 tCO2 eq. until 2012.

(i) Amount of CERS generated by the projects that will be acquired by the Member State: 95 % of the amount generated by the project.

(j) Credits accrued until the end of reporting year: provide information on the number of credits (total and annual) obtained from joint implementation projects, clean development projects and credits resulting from land use, land use change and forestry activities: 12.500 t CO2eq. should be generated in 2009

6) An ERPA was signed between the federal Government and Howrah Mills Company Limited

(a) Project title and category (JI/CDM): “Substitution of coal with jute biomass residue (caddies) in thesteam generating boiler for use onsite” – CDM project.

(b) Host country: India

(c) Financing: private

(d) Project type: renewable energy generation (biomass)

(e) Status: in operation

(f) Lifetime:

- date of official approval (e.g. of the Executive Board for clean development mechanism projects, of the host country for joint implementation projects): not yet available
- Date of project initiation (operation starts): February 2000
- Expected date of project termination (lifetime): 20 years;

- Crediting period (for what years will ERUs or CERs be generated): 10 years (fixed) starting in May 2007;
- Date(s) of issue of emission reduction units (ERUs)(by host country) or certified emission reductions (CERs)(by CDM executive board): Each year from 1 July 2009 until 1 July 2013

(g) First or second track approval procedure (For joint implementation projects only): -

(h) Projected total and annual emissions reductions that accrue until the end of the first commitment period: 4 777 t CO2eq/year or 28 664 tCO2 eq. until 2012.

(i) Amount of CERS generated by the projects that will be acquired by the Member State: 73 % of the amount generated by the project (20 869 CER's).

(j) Credits accrued until the end of reporting year: provide information on the number of credits (total and annual) obtained from joint implementation projects, clean development projects and credits resulting from land use, land use change and forestry activities: 11 605 t CO2eq. should be generated in 2009

- Brussels Capital Region:

See question 6. We consider that our participation to the CDCF will generate +/- 100.000 t CO2/year (CER) during the first commitment period. This estimation is based on the information communicated by the World Bank.

- Flemish Region:

Globally the flemish Region has already invested 55,4 million euros with an estimated result of 5,5 Mton CO_2-eq.

Information with regard to the ERPAs signed by the CFE can be found on the World Bank website[1]. The available information has been summarized in the table below. The amount of CERS generated by these projects that will be acquired by the flemish Region remains confidential information

Country	Project name	CFE ERPA Emission Reductions tCO_2e**	Total Project Emission Reductions Generation tCO_2e	UNFCCC Reference No.
Egypt	Cairo Southern Zone Composting	219.243	536.565	Not yet available
Jordan	Amman Landfill Gas Project	900.000	1.519.963	Not yet available
Malaysia	Kota Kinabalu Composting Project	340.000	737.380	Not yet available

** Exclusive of options

At the moment all project and ERPA information with regard to the Flemish participation in the MCCF and the APCF remains confidential. This is also the case for the ERPA concerning the small scale reforestation project in Bolivia.

[1] wbcarbonfinance.org/Router.cfm?Page=CFE&FID=30444&ItemID=30444&ft=Projects

The Flemish Region has signed one ERPA for the following projects:

(a) Project title and category (JI/CDM): Copiulemu landfill gas project (Center for the Storage and Transfer, Recovery and Control of Waste, Treatment and Disposal of Industrial and Household Waste) and Cosmito landfill gas project (Improvement of Gas Extraction System in Old Cosmito Dump), CDM

(b) Host country: Chile

(c) Financing: private

(d) Project type: landfill methane recovery

(e) Status: in operation

(f) Lifetime:

- *Cosmito landfill gas project:*

  — date of official approval: 03/12/2005

  — date of project initiation (operation starts): 16/05/2006,

  — expected date of project termination (lifetime): 21 years

  — crediting period: 16/05/2006 – 14/01/2013

  — date(s) of issue of emission reduction units (ERUs) (by host country) or certified emission reductions (CERs) (by CDM executive board): -

- *Copiulemu landfill gas project:*

  — date of official approval: 03/12/2005

  — date of project initiation (operation starts): 27/05/2006,

  — expected date of project termination (lifetime): 25 years

  — crediting period: 27/05/2006 – 14/01/2013

  — date(s) of issue of emission reduction units (ERUs) (by host country) or certified emission reductions (CERs) (by CDM executive board): -

(g) First or second track approval procedure (For joint implementation projects only): -

(h) Projected total and annual emissions reductions that accrue until the end of the first commitment period:

- *Cosmito landfill gas project:* 84.724 tCO_2eq/year, 593.071 tCO_2eq (first commitment period)

- *Copiulemu landfill gas project:* 90.125 tCO_2eq/year, 630.878 tCO_2eq (first commitment period)

(i) Amount of CERS generated by the projects that will be acquired by the Member State: confidential information

(j) Credits accrued until the end of reporting year: provide information on the number of credits (total and annual) obtained from joint implementation projects, clean development projects and credits resulting from land use, land use change and forestry activities: -

- Walloon Region:

See question 6. We consider that our participation to the CDCF will generate +/- 100000 t CO_2/year (CER) during the first commitment period. This estimation is based on the information communicated by the World Bank.

Questionnaire on the use of activities under Articles 3.3 and 3.4 under the Kyoto Protocol

Wherever possible, please provide answers to the questions below. If the questions below were answered in previous years, it is sufficient to include changes or additions to the information provided previously. Please indicate also references or sources where further information related to the questions could be obtained.

1. Does your country have quantitative estimates of the projected anthropogenic greenhouse gas emissions and removals from forestry activities under Article 3.3 of the Kyoto Protocol during the commitment period? If available, please indicate any projected estimates per activity (afforestation, reforestation and deforestation) as well as projected net estimates under Article 3.3 and indicate the carbon pools covered by the estimates. If no quantitative projections are available, please include qualitative information if forestry activities under Article 3.3 are expected to be a net source or a net sink during the commitment period.

No quantitative estimate is available for the time being. A study will be conducted this year, with a view to report on Art.3.3 in 2010.

From a qualitative point of view, forestry activities under art 3.3 are *expected* – and this *expectation* should be read with cautiousness- to be close to the balance between carbon emissions and sequestration; but it cannot be said if they would tend to be a sink or a source.

2. Does your country have quantitative estimates of the projected net anthropogenic greenhouse gas emissions and removals from activities under Article 3.4 for the first commitment period? If available, please indicate the estimates per individual activity (forest management, cropland management, grazing land management or revegetation) and indicate the carbon pools covered by the estimates. If you intent to account for forest management, will the country-specific maximum for forest management activities agreed in the Marrakech Accords be fully utilized by your country?

One study in relation with art 3.4 was published in 2004

http://www.bib.fsagx.ac.be/base/text/v8n1/27.pdf

However, in its initial report under the Kyoto Protocol, Belgium did not elected any activity under art 3.4 for the first commitment period