NATIONAL
CLIMATE COMMISSION

2017

BELGIUM'S SEVENTH NATIONAL COMMUNICATION AND THIRD BIENNIAL REPORT ON

CLIMATE CHANGE

Under the United Nations Framework Convention on Climate Change

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Edited by the National Climate Commission – December 2017

Published and distributed by the
Federal Public Service Health, Food Chain Safety and Environment

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Introduction

This document represents the Belgium's 7th National Communication required under the United Nations Framework Convention on Climate Change, as reaffirmed by UNFCCC decision 9/CP.16 and UNFCCC decision 2/CP.17. It provides a comprehensive overview of climate change-related activity at Belgian level. As defined in the UNFCCC reporting guidelines for National Communications, the information is structured into:

- National circumstances relevant to greenhouse gas emissions and removals (Chapter 2),
- Greenhouse gas inventory information (Chapter 3),
- Policies and measures (Chapter 4),
- Projections and the total effects of policies and measures (Chapter 5),
- Vulnerability assessment, climate change impacts and adaptation measures (Chapter 6),
- Financial resources and transfer of technology (Chapter 7),
- Research and systemic observation (Chapter 8),
- Education, training and public awareness (Chapter 9).

Following provisions of decision 2/CP.17 developed country Parties were requested to submit their first biennial report (BR1) to the secretariat by 1 January 2014 and their second and subsequent biennial reports two years after the due date of a full national communication. As endorsed in UNFCCC decision 2/CP.17, Belgium has opted to submit its 3rd Biennial Report as an annex to this 7th National Communication (Annex 2). The tables as defined in the common tabular format for the UNFCCC biennial reporting guidelines for developed country Parties (UNFCCC decision 19/CP.18) have been submitted to the UNFCCC through the electronic reporting facility provided by the UNFCCC secretariat as required by UNFCCC decision 19/CP.18.

In order to avoid unnecessary duplication of information, overlapping contents between the 7th National Communication and the 3rd Biennial Report has been limited as much as possible, sections of the 3rd Biennial Report contain mainly references to the corresponding sections of the 7th National Communication's and/or CTF tables.

A summary table outlining the location of supplementary information required under Article 7, paragraph 2, of the Kyoto Protocol within this National Communication is provided in Annex 1.

1. Executive summary

National circumstances relevant to greenhouse gas emissions and removals

Belgium is a small country (30 528 km²) in north-western Europe. Belgium is highly urbanised and is the third most densely populated country in Europe (363 inhabitants/km² in 2015).

Belgium's temperate maritime climate is characterised by moderate temperatures. The evolution of temperatures in the past century reveals an upward trend, a phenomenon that has been accentuated in recent years.

Belgium is a federal state composed of three language-based communities and three regions, each with its own executive and legislative bodies.

Given Belgium's federal structure and the division of powers, several structures have been created to promote consultation and cooperation between the different levels of power and to ensure consistency in the action of the federal state and its entities. The central coordination body with regard to national climate policy is the National Climate Commission.

Belgium has a very open economy, situated at the heart of a zone of intense economic activity. The Belgian economy is dominated by the services sector. Exports of goods and services accounted for 84 % of GDP in 2015 and imports 83 %.

The gross domestic product has constantly increased since 1990 (with a small drop related to the financial crisis in 2008-2009) amounting 421.611 billion euros in 2016 (average GDP growth 2005-2015: 1.2 %). At the same time, GHG emissions could be stabilized (1990-2005), then followed a decreasing trend up to now (-20 % in 2015, compared to 1990). The main drivers for decoupling are: increased use of gaseous fuels (decreased use of liquid and solid fuels), higher energy efficiency, changes in the structure of the economy (less highly energy intensive industries like steel and more added value in sectors –services and commercial sectors- with lower energy intensity).

Greenhouse gas emissions per GDP unit were 287 tons per billion EUR in 2015 (excl. LULUCF).

Energy

Energy intensity follows a downward trend since 1990, reflecting the decoupling of economic growth from primary energy consumption.

In terms of market shares of total final consumption, oil products remain the dominant energy source (52%), followed by natural gas (24%) and electricity (17%).

The residential sector is the main consumer of primary energy (32.2%), followed by industry (25.8%) and transport (21.5%).

In the industrial and residential sector, natural gas is the leading fuel (respectively 35% and 38% in 2015).

Consumption in the transport sector is dominated by petroleum products (95%). Non-energy consumption is also dominated by petroleum products (86%).

Belgium has limited energy resources, its total primary energy production represents approximately 20% of Belgium's total primary energy consumption. Belgium is consequently highly dependent on other countries for supply. 63.7% of Belgian energy production consists of nuclear energy. The share of renewable fuels and waste amounts to 26.5%.

The dependency on fossil fuel imports to meet domestic demand is very high. In 2015, the ratio between net-imports and primary energy consumption was 95%. Alongside petroleum imports, the country also imports natural gas. For the last decade Belgium was a net-importer of electricity, except in 2009.

Belgium has made progress in developing renewable energy in recent years. In 2015, the share of renewable energy amounted to 7.88% of the total final energy consumption.

Transport

Belgium is crisscrossed by an important network of waterways and a very dense communications network (roads and railways). Owing to Belgium's location as a transit country, transport is a growing sector. Road transport is the most energy-consuming means in Belgium. The number of passenger cars is increasing continuously (motorisation rate in Belgium is very high: one car for every two inhabitants). Road transport still accounts for most of land transport of goods. Demand for fossil fuels in the sector is expected to continue to rise.

Industry

Although the weight of the industrial sector (in particular heavy industry) in the economy has declined since the '60s, it continues to be a relatively important component of Belgium's economic activity (almost 15% of GDP).

Main contributors to greenhouse gas emissions are: energy combustion (mainly through the production of electricity and heat, but also to oil refining), industrial processes (mainly from the chemical industry, mineral products industry and metallurgy) and energy transformation (iron and steel industry, chemical industry, food and beverage processing and cement plants).

Waste

Between 2004 and 2014, waste production increased by 24%. Significant improvements in waste treatment have helped to sharply reduce the amount of waste put into landfills.

Housing stock

Since 1995, the number of buildings has increased by 12%. Over the same period, the number of residences increased by 20%. Belgian housing stock is characterised by a high proportion of old buildings. Natural gas is the main heating source. The housing equipment rate of appliances using energy continues to rise.

Agriculture

Belgian agriculture is specialised in market-garden and horticultural crops, cereals, potatoes, sugar beets, livestock and milk production. Although agricultural land occupies the greater part of the territory (44%), the number of farms has continued to decrease in recent years. The share of agriculture in the Belgian economy continues its decline and is now less than 1% of GDP. Despite a high population density, forests and other natural areas remain relatively stable (23% of the territory).

Greenhouse gas inventory information

In Belgium, emissions of all gases have decreased by 19.7% compared to 1990 and 20.7% using 1995 as the base year for the fluorinated gases (excluding LULUCF). The largest contribution to total emissions is CO_2, which contributed 85.4% in 2015. Emissions of CH_4 account for the next largest share with 6.9% and emissions of N_2O make up a further 5.1%.

In 2015 the energy sector contributed 75% to the total emissions (excluding LULUCF). Since 1990, emissions have decreased by about 20%. Energy industries and manufacturing industries are both responsible for almost 40% in this decrease, while transport emissions increased by 22%.

A switch from solid fuel to gaseous fuels is observed in the electricity production sector and industry. This, together with the development of biomass fuels in some sectors, has resulted in a lower CO_2 emission

factor for a given level of energy consumption. A more rational use of energy is also developing but it often goes together with larger use of electricity, so its impact on actual emissions is generally harder to quantify. Finally, the closure of certain iron and steelworks over the past few years has also helped to cut emissions.

Compared to recent years, emissions from the residential and tertiary sectors decreased in 2015 although a number of indicators are rising such as the increase in residences and a greater number of employees in the tertiary and institutional sectors. This is due to a switch of fuels, better insulation and milder years. However, the trend for the tertiary sector since 1990 continues to be a net increase in emissions, due to the development of activity in this sector.

Emissions caused by road transport have been increasing continually since 1990 on account of the rising number of cars and traffic that has become more intense. Traffic growth, however, has slackened significantly in recent years.

Industrial processes and product use make up the second largest source of greenhouse gases in Belgium, amounting to 17% of the national total in 2015. Emissions have declined by 25% since 1990. All the sectors are concerned but the metal industry has experienced the most severe decrease.

Agriculture represents 8.7%. of the total emissions, mainly from CH_4 and N_2O. Some CO_2 emissions are caused by liming. Since 1990, emissions from this sector have decreased by 18%, due to a decline in emissions from enteric fermentation (related to lower livestock numbers but also to the shift from dairy cattle to brood cattle) and agricultural soils (reduced use of synthetic fertiliser and livestock reduction leading to less nitrogen excreted on pasture).

Land Use, Land-use Change and Forestry sector presents sinks as well as sources of CO_2 emissions. However LULUCF is a net sink in 2015, as it is for the complete time series.

In 2015, the waste sector contributed around 1.4% to the national total. Emissions originate from waste incineration, solid waste disposal on land and wastewater handling. Emissions from this sector have steadily declined and are 63% below 1990 levels in 2015 mainly due to biogas recovery and use in solid waste disposals.

Policies and measures

In the Belgian federal system, responsibilities and policy-making powers are shared between the Federal State and the three Regions (the Walloon, Flemish and Brussels-Capital Regions). Therefore, climate change policies are designed and implemented by the federal and regional governments, which set up their own priorities and objectives within the scope of their powers.

Regions have major responsibilities in areas such as rational use of energy, promotion of renewable energy sources, public transport, transport infrastructure, urban and rural planning, agriculture and waste management. In the context of the 6th Belgian state reform they have also obtained new fiscal responsibilities.

The Federal state is still responsible for large parts of taxation policy. It is also responsible for product policies (norms, fuel quality, labelling and performance standards for household or industrial electrical goods…). It is responsible for ensuring the security of the country's energy supply and for nuclear energy. It also supervises territorial waters, which implies that it is also responsible for the development of offshore wind farms.

A National Climate Plan (NCP) for the period 2009-2012 was adopted in April 2009, built upon policies and measures elaborated by each of the 4 decisional entities. This plan has already been described in the NC6. It remains in application until the first National Energy and climate Plan (NECP2030) is adopted for the period 2021-2030.

The new NECP 2030 will have to be adopted at the latest by the end of 2019, in accordance with the European regulations (package "Clean energy for all Europeans"). An important prospective work on PAMs is underway, both at the national level and within the federated entities.

Projections and the total effect of policies and measures

The projections described in this report are based on the 2017 Belgian submission to the European Commission in compliance with Articles 3 and 14 of Regulation (EU) No 525/2013. The "With Existing Measures" (WEM) scenario includes implemented and adopted regional and federal measures at the end of 2016, for the projected Belgian greenhouse gas emissions over the period 2015-2035. The different entities in Belgium are working on a national integrated climate and energy plan for the period 2021-2030. In the framework of this process additional measures are being explored but are not yet sufficiently elaborated to be included in a "With Additional Measures" (WAM) scenario. There have been no significant changes in the modelling tools and methodologies since the last reporting of the national communication and biennial report.

The reported WEM 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 aggregated regional bottom-up projections are compared with national projections calculated by the Federal Planning Bureau based on a macro-sectoral top-down econometric model (HERMES). The top-down HERMES projections result in a decrease of total emissions between 2015 and 2030 amounting up to 5 Mton while the bottom up projections show a smaller reduction in this period. The resulting trends for the different sectors are very different between the two modelling approaches.

Sensitivity analyses have been performed for some important parameters such as number of degree-days and import of electricity without however taking indirect effects into account.

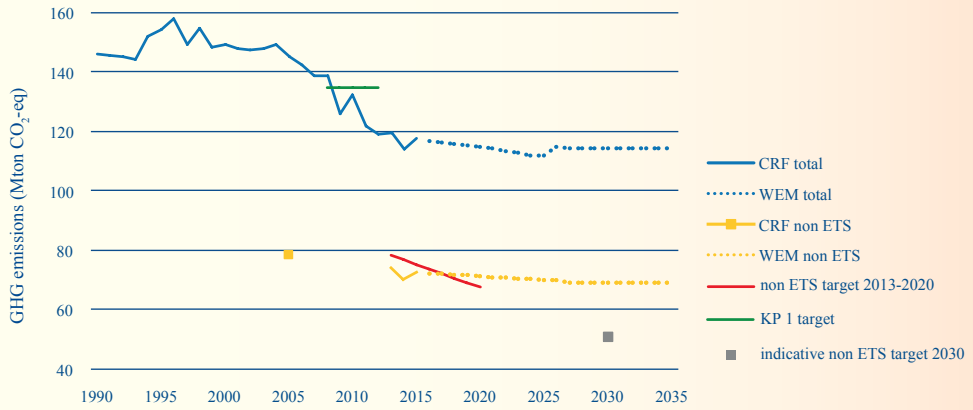
The projection results presented in this report have been compared with the previous reports (NC6 and BR2). The main differences can be explained by the different sectoral assumptions. In particular, the changes in the nuclear phase-out assumptions lead to a significant impact on the total greenhouse gas projections. There are no significant differences in the non-ETS projection results.

There is a clear decrease between 1996 and 2015 in the total greenhouse gas emissions in the inventory. However, the total emissions in the WEM scenario remain more or less stable at 114 Mton CO_2-eq in the period 2015-2035 (Figure 1.1). These projections do not include emissions nor removals from LULUCF. Projections with the macro-economic model suggest a decrease in emissions from 2014 to 2030 from 114 Mton CO_2-eq to 109 Mton CO_2-eq.

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

A greenhouse gas emission limit of -15% in 2020 compared to 2005 greenhouse gas emissions levels has been fixed for Belgium in the Effort Sharing Decision (Decision No 406/2009/EC). This results in an emission reduction path for the non-ETS sectors in Belgium. An indicative comparison of the inventory data for the period 2013-2015 and the WEM projection scenario for the period 2016-2020 with the AEAs for the entire period 2013-2020 shows an annual AEA surplus in the period 2013-2017 and annual AEA shortage in the period 2018-2020 at the Belgian level. Cumulated in the period 2013-2020 this evaluation indicates a net surplus of about 8.9 million AEAs.

Figure 1.1: GHG emissions excluding LULUCF



Vulnerability assessment, climate change impacts and adaptation measures

Belgium is now 2.4 °C warmer than in the pre-industrial period. Our country also witnesses a slow but significant increase in the annual precipitation. This increase shows in winter. The number of days of heavy precipitation is increasing, leading to higher flood risks. Heavy rainfall occurs mostly in summer because of heavy thunderstorms that occur in a space of a few hours. Periods of drought have not become more intense since the end of the 19th century. The most harmful climate effects for Belgium are expected to come from the increased frequency and intensity of extreme events such as heat waves.

The annual average sea level in 2015 is significantly higher than at the beginning of the time series (1951). Belgium is highly vulnerable to flooding as a result of the rising sea level: in Flanders, 15% of the surface area is less than 5 metres above the average sea level. Moreover, the Belgian coastline appears to be the most built-up in Europe.

Since previous national communication, new climatic projections have been built for the Belgian territory, based on greenhouse gas concentration trajectories or RCPs (Representative Concentration Pathways) adopted by the IPCC in their latest Assessment Report. General climate trends for Belgium over 100 years can be summarised as follow: a hotter climate, a reinforcement of the precipitation seasonality (decrease in summer and increase in winter), more extreme events (more frequent or intense heavy rains in winter, more intense or frequent heat waves and heavy thunderstorms in summer), a fall in the average summer precipitation, a rise of the sea level at the Belgian coast (most likely between 20 and 90 cm by 2100).

Spurred on by the developments at European level, Belgium has made significant progress in terms of adaptation policy. Since the adoption in 2010 of the national adaptation strategy, impact, vulnerability and adaptation assessments have been funded and piloted at regional and federal level. These preliminary studies were the first step to develop adaption plans by identifying a number of vulnerable sectors that need to adapt.

The federal level and the three Regions have now adopted their own adaptation plan. In addition, the National Adaptation Plan of Belgium complements the regional and federal plans by identifying specific adaptation measures that need to be taken at national level in order to strengthen cooperation and develop synergies between the different entities on adaptation. Also some provincial and local governments are developing adaptation plans.

Cross-cutting focus groups have been established and research programmes launched to improve the understanding of the effects of climate change and adaptation. In this respect, the value of certain exploratory projects should not be underestimated. Good examples include i.a. the Cordex.be project and its impact studies on the impact of climate change on agriculture, urban heat stress and urban environment, the Interreg project 'Future cities', the MODIRISK programme which takes stock of exotic and endemic species of mosquitoes, the CREST project aiming to increase the knowledge of coastal processes near the coast and on land, the FORBIO climate project analysing the adaptive capacity of tree species under different climate scenarios, etc.

Adaptation measures are already taking place and mainstreaming is ongoing i.a. in spatial planning, water and flood management (Plan PLUIES, SIGMA plan), coastal area (coastal safety master plan), biodiversity (national biodiversity strategy), agriculture (climatic agri-environmental measures), forestry (Walloon Forest Code and Brussels plan for managing the Forêt de Soignes/Zoniënwoud woodland area, monitoring programme), transport ("Summer" and "winter" plans drawn up by public transport managers), health (heat and ozone plans, monitoring), etc.

The information and awareness-raising of the Belgian population, as occurs in the case of water or heat wave campaigns, constitute an important aspect.

New or innovative processes may be very diverse. The Flemish new industrial policy seeks for answers to the new challenges.

Progress also occurs in the governance with a much greater collaboration between the regional and the local level: regional governments encourage and support the cities and municipalities to sign the Covenant of Mayors and to develop local action plans, by providing funds and tools.

In the context of development cooperation, the new Belgian Development Cooperation Act includes the protection of the environment and natural resources, as well as the fight against climate change, as one of two important transversal priorities. In order to facilitate the integration of this priority, a university research platform has been set up ('Klimos') and has developed an Environment Sustainability Toolkit. In addition, various initiatives for capacity building within Belgian development cooperation were organised. Belgium also supports international agricultural research, among other things by means of the Consultative Group on International Agricultural Research (CGIAR).

Financial resources and technology transfer

Over the period 2013-2016, Belgium provided 334.1 million euro of public support to developing country Parties, mainly through grants and some concessional loans. This financial, technological and capacity-building support to non-Annex I Parties mainly focused on:

- Predominantly adaptation and cross-cutting activities;
- Provision of bilateral and multilateral support under the form of grants;
- Contributions mainly directed towards Africa and Least Developed Countries (LDCs);
- Contributions to climate-specific multilateral funds (Green Climate Fund, Adaptation Fund, Least Developed Countries Fund, etc.) or specialized UN agencies;
- Mainly in the following sectors: multisectoral, agriculture and livestock, energy, water and sanitation and environment.

At the Conference of the Parties in December 2015 Belgium announced that it would contribute at least 50 million EUR yearly to international climate finance. According to a negotiated internal distribution ratio the federal government accounts for half of this yearly commitment. The regions provide the other half as follows: 14.5 million EUR by the Flemish region, 8.25 million EUR by the Walloon region and 2.25 million EUR by the Brussels Capital region.

In parallel to its long-standing provision of public climate finance to developing countries, Belgium also supports the efforts of developing countries to implement low-emission, climate-resilient projects and programmes by (i) providing significant core funding to multilateral organizations and (ii) mobilizing, through public means, private investments for climate-related projects in developing countries.

Research

The science policy within Belgium undergoes major changes on the institutional level.

Within Belgium there is no specific 'thematic' research programme related to climate research, nor on the federal level, nor on the regional level. However there are several funding instruments which could fund climate related research. On the federal level, that will be in the future BRAIN-2 (2018-2022) and FEDtWIN (2015-2022). At the community level, the main funding through the agencies FNRS and FWO is competitive and based on the principle of 'excellence'. Regional institutions such as Innoviris, EWI or DGO6 also fund climate relevant research.

Public awareness, education and training

Effective reduction of greenhouse gas emissions requires that all levels of society be well informed. Luckily, the most recent public survey, organized early 2017 by the federal Climate Change Service, indicates that the Belgians are already quite well aware of the problem: 85 % of them think that climate change is a problem that urgently needs to be tackled. Such high scores are also obtained on statements about the global character of climate change (83 %), the already visible consequences (84 %) and the scientifically proven human cause (80 %) (see 9.1).

This chapter reports on the actions undertaken in Belgium to raise public awareness of climate change and to educate and train certain target groups during the period 2014-2017. It essentially presents the activities organised or financed by the public sector (the federal and regional levels), and actions undertaken by organisations of civil society or the private sector, often made possible by public funds. This approach inevitably excludes all small-scale local initiatives, being beyond the scope of this publication. Finally, a list of relevant internet sites is provided.

Nr.	Activity	Target groups							
9.2	RAISING OF AWARENESS	Citizens	Organisations	Authorities	Business	Lower education	Secondary education	Higher education	Abroad
	GLOBAL WARMING								
9.2.1	Awareness raising by the federal and regional governments	×	×	×	×			×	
9.2.2	Earth Hour	×		×					
	ENERGY SAVINGS								
9.2.3	October, Month of Energy-Saving	×							
9.2.4	Avoid energy-guzzlers at home	×							
9.2.5	The TopTen website	×			×				
9.2.6	Energy-saving investments	×			×				
9.2.7	Assistance to disadvantaged groups of residents	×							
9.2.8	Energy consultants	×	×		×				
9.2.9	Enerpedia - Energy Knowledge Centre for Agriculture				×				
	BUILDINGS								
9.2.10	Guidance for consumers	×							
9.2.11	Guidance for professionals				×				
9.2.12	Knowledge platforms for passive buildings	×			×				
9.2.13	Energy efficiency certificates and audits	×		×	×				
9.2.14	Eco-construction		×		×				
	MOBILITY								
9.2.15	Promotion of sustainable mobility	×	×	×	×	×	×	×	
9.2.16	Eco-driving	×	×	×	×				
9.2.17	Raising awareness on the purchase of energy efficient vehicles	×		×	×				
9.2.18	Logistics consultants				×				
	ENVIRONMENT AND SUSTAINABLE DEVELOPMENT								
9.2.19	Belgian Environmental Awards	×	×	×	×	×	×	×	
9.2.20	Eco-efficiency scan				×				
9.2.21	Corporate social responsibility				×				
9.2.22	Sustainable Neighbourhoods	×			×				
9.2.23	The ‘Eco-dynamic Enterprise’ label				×				
9.2.24	The Walloon Youth Parliament for Sustainable Development						×	×	
9.2.25	Sustainable Development Days in Wallonia	×	×	×		×	×	×	

Nr.	Activity	Target groups							
9.3	EDUCATION AND TRAINING	Citizens	Organisations	Authorities	Business	Lower education	Secondary education	Higher education	Abroad
	EDUCATIONAL PROJECTS								
9.3.1	Educational climate dossier					×			
9.3.2	The 'Climate Challenge' website						×		
9.3.3	The 'Climate Challenge @ School' conferences						×		
9.3.4	The My2050 webtool						×		
9.3.5	Invite a Climate Coach into your (secondary) school						×		
9.3.6	Solidar'Climat						×		
9.3.7	Symbiose "climat"						×		
9.3.8	Initiatives addressing energy efficiency in schools			×		×	×		
9.3.9	The MOS project (Milieuzorg Op School - Respect for the environment at school)					×	×		
9.3.10	Cooperation Agreement on education concerning the environment, nature and sustainable development					×	×		
9.3.11	Raising environmental awareness for schools					×	×		
9.3.12	The network of Regional Centres of Initiation to the Environment (CRIE)	×				×	×		
9.3.13	The educational Forum on the environment and sustainable development					×	×		
9.3.14	Ener'jeunes					×			
9.3.15	Idea Network					×	×		
9.3.16	Good Planet					×	×		
9.3.17	Commitment to the planet and energy ambassadors					×	×		
9.3.18	Going to school by bike					×			
9.3.19	Thick Jumper Day				×	×	×		
9.3.20	Association for the promotion of renewable energy (APERe)	×	×	×	×				
9.3.21	Training for building professionals				×				
	HIGHER EDUCATION								
9.3.22	Awareness-raising at the university							×	
9.3.23	Education on Environment and Sustainable Development							×	
9.3.24	Teach the future teacher							×	
	INTERNATIONAL COOPERATION AND EDUCATION IN SOUTHERN COUNTRIES								
9.3.25	Federal initiatives								×

Awareness raising

Relatively few actions relate solely to the global warming issue. Many more focus on other thematic issues having a clear effect on climate change: energy savings, energy efficient buildings, environmentally friendly mobility, or – broader - environment and sustainable development. The structure of the chapter follows this logic, although in some cases this subdivision may seem trivial due to overlap between themes (e.g. energy-saving investments are also made in buildings), which is not surprising as climate change is a typical cross-sector phenomenon.

Education and training

Children and adolescents (increasingly) form a priority target group: there is a broad range of educational materials and activities addressing the various age groups. Environmental education has gained a firm foothold in the Belgian education system and is increasingly linked to awareness-raising initiatives outside the school environment. The education-linked activities are carried out by a wide range of actors, often NGOs in collaboration with authorities, the latter offering the necessary funding.

In higher education too, the interest in climate change is further increasing. Instead of making a full inventory of climate related colleges, we mention a few successful project examples. Finally, this section also describes some federal initiatives promoting climate change related capacity building in southern countries.

Internet sites

The list of relevant internet sites is being structured the same way as the awareness raising activities (energy, buildings, mobility, environment and sustainable development). Some of them present the authorities and organizations offering information or projects related to one or more of the above mentioned themes, others are specific campaign or project sites. In order to give an overview of the main players in the field of education, we also added a category “main educational actors and networks”. ■

2. National circumstances relevant to greenhouse gas emissions and removals

A brief overview of Belgium

Population (on 1 January 2016)	11 267 910 inhabitants
Surface area	30 528 km²
Capital	Brussels
Head of State	HM King Philippe
Prime Minister	Mr Charles Michel
National languages	Dutch, French and German
Currency	Euro
GDP 2016 (current prices)	421.611 billion EUR
GDP growth rate 2016 (volume, variation from previous year)	1.2 %
Inactive population (2015) [1]	4 355 764
Agriculture (Gross added value by sector at current prices, 2016)	2 775 million EUR
Industry (Gross added value by sector at current prices, 2016)	63 001 million EUR
Construction (Gross added value by sector at current prices, 2016)	20 700 million EUR
Services (Gross added value by sector at current prices, 2016)	216 488 million EUR
Population density (on 1 January 2016)	369 inhabitants per km²
Highest point	Signal de Botrange (694 m)
Average temperature (Uccle, since 1980) [4]	11° Celsius
Precipitation (Uccle, 2016)	942 mm
Hours of sunshine (Uccle, 2016)	1 572 hours

2.1. Institutional structure

2.1.1. Federal structure of the state

After becoming independent in 1830, Belgium gradually moved on from a unitary to a federal structure. Today Belgium is a federal state composed of three communities and three regions.

The three communities are the Flemish Community, the French Community and the German-speaking Community. The three regions are the Flemish Region, the Brussels-Capital Region and the Walloon Region. The communities and regions partially overlap. The French Community exercises its authority in the Walloon Region with the exception of German-speaking municipalities, and in Brussels; the Flemish Community exercises its authority in the Flemish Region and in Brussels; the German-speaking Community exercises its authority in the german-speaking municipalities of the Walloon Region (Figure 2.1).

Each of the communities and regions has its own legislative and executive bodies. In Flanders, the community and regional institutions have merged, so that there is only one Flemish council and one Flemish government (Figure 2.1).

The Federal state, Communities and Regions are all equal under law. They intervene on an equal footing but in different areas.

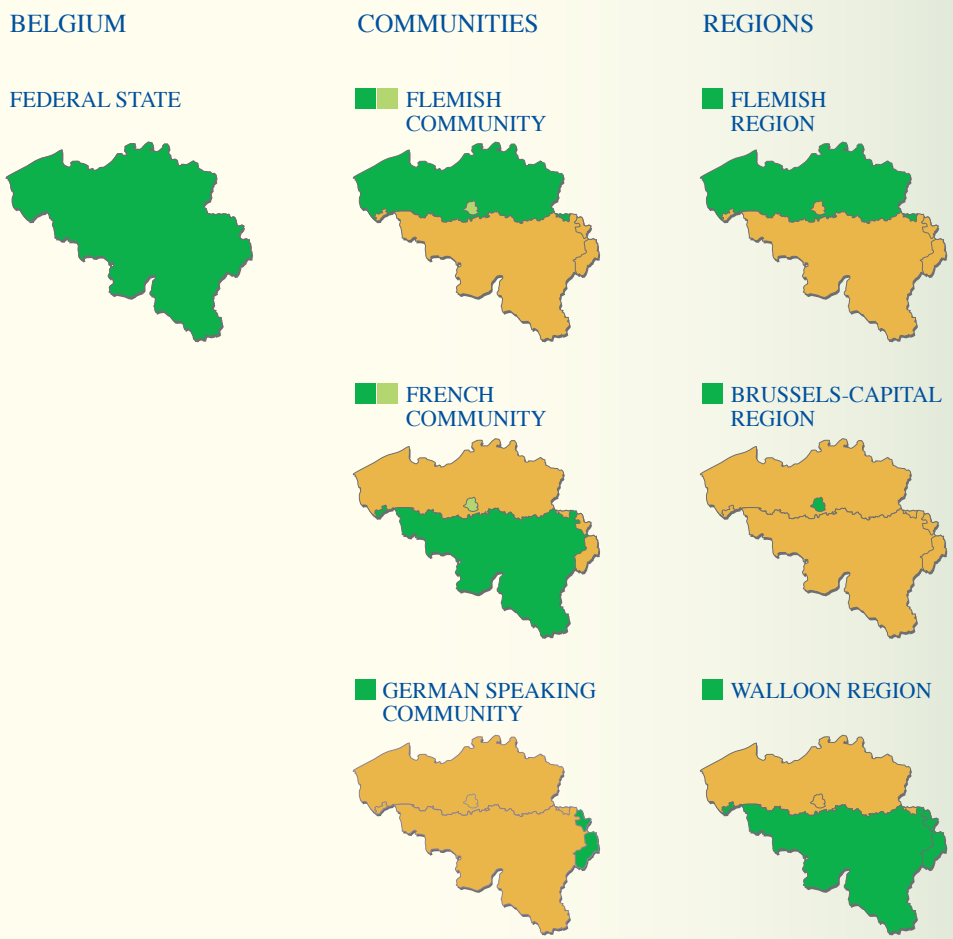
2.1.2. Division of powers

The Federal State is responsible for key policies such as foreign affairs (incl. development cooperation), defence, justice, finance, social security and a considerable part of public health matters and internal affairs. It also exercises competences in the following areas (which are 'mixed competences', being exercised both at federal and regional or community level): economy, transport, environment, energy, research, cities.

Communities powers concern matters related to 'individuals': culture (theatre, libraries, audio-visual, etc.), education, use of languages and matters that can be 'personalised', including some aspects of health policy (preventive and curative medicine) and assistance to individuals (youth protection, social assistance, family assistance, reception of immigrants, etc.). Communities are also responsible for scientific research and international relations in the areas under their authority.

Regions have powers in 'territory-related' areas, in a broad sense. They are responsible for the economy, employment, agriculture, water policy, housing, public works, energy, transport (with the exception of the national railway, SNCB/NMBS and Infrabel), environment, town and country planning, rural revitalisation,

Figure 2.1: Belgium, a federal state



Source: FPS Chancellery of the Prime Minister

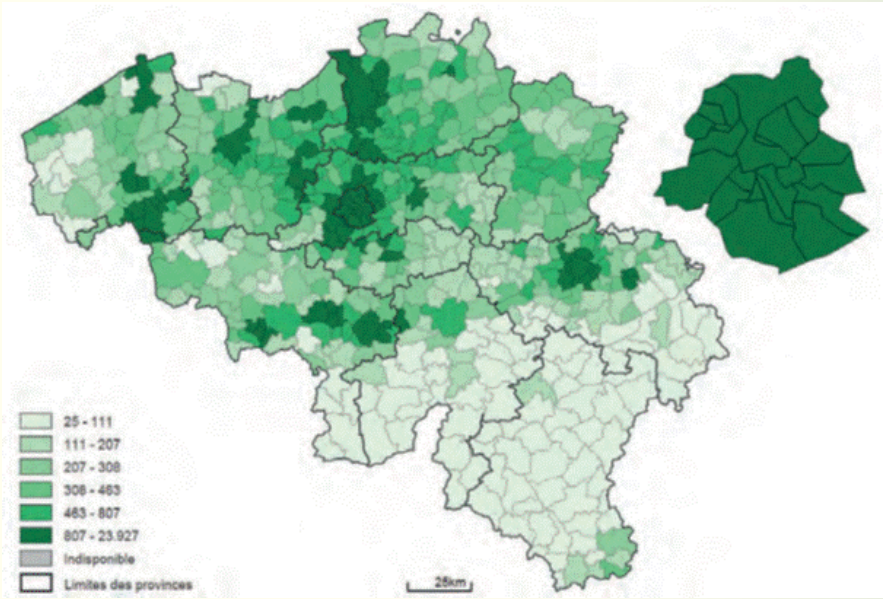
nature conservation, credit, foreign trade, and provincial, municipal and intermunicipal administration. They are responsible for scientific research and foreign relations in the above-mentioned areas.

In the framework of the sixth institutional reform which entered into force in July 2014, new transfers of competence have taken place leading to increased autonomy for the federated entities. They acquired greater competences in the context of family allowances, employment policy, healthcare or caring for older people. Within this reform, large parts of fiscal matters were transferred from the federal authority to the Regions, which are notably now responsible for taxes on cars and transport and tax exemptions for rational use of energy (RUE) investments.

2.1.3. Coordination structures relating to climate policy

Given Belgium's federal structure and the division of powers, several structures have been created to promote consultation and cooperation between the different levels of power and to ensure consistency in the actions of the federal state and its entities. The central coordination body with regard to national climate policy is the National Climate Commission, established by the cooperation agreement of 14 November 2002, and which is notably in charge of the establishment and follow-up of the National Climate Plan, and the execution of international and European reporting obligations. For more detailed information about this Commission and other institutional arrangements with regard to climate policy, we refer to Chapter 2.1 of Belgium's 6th national communication and Chapter 4.1.1.

Figure 2.2: Population density by municipality on 1st January 2015



Source: FPS Economy – FPS Economy - Directorate-General Statistics and Economic Information [1]

2.2. Population profile [1]

On the 1st of January 2016, the population of Belgium was 11 267 910 inhabitants. This represents 2.2% of the total population of the European Union (Belgium is the 9th most populated Member State of the European Union). Belgium is very densely populated. With an average density of 363 inhabitants/km² (2015), it is the third highest densely populated country in Europe. However, this density varies from one part of the country to another, the north of the country being much more densely populated than the south. Currently, the Flemish Region makes up 57.5% of the population, the Walloon Region 32.0% and the Brussels-Capital Region 10.5%

The declining birth rate, marked improvement in medical care and a more selective immigration policy have gradually led to a reduction in natural growth and the ageing of the population.

Belgium GHG intensity in 2015 (10.5 tonnes CO_2-eq/capita) is significantly lower than in 1990 (14 tonnes CO_2-eq/capita in 1990). It remains higher than EU CO_2 intensity which has decreased from 12 to less than 9 tonnes/capita between 1990 and 2015.

2.3. Geographic profile

This chapter provides general information on Belgium's geographic profile, for more information we refer to Chapter 2.3 of Belgium's 6th national communication.

2.3.1. Geographic situation and relief

Belgium is a small country (surface area of 30 528 km²) in north-western Europe and covers 3 454 km² of the North Sea. It has 1 482 km of borders with the Netherlands, Germany, Luxembourg, France and the North Sea (its coastline is 73.1 km long). The Walloon Region occupies the biggest part of the territory (55.2 %), followed by the Flemish Region (44.3 %) and the Brussels-Capital Region (0.5 %). Belgium has three zones of elevation, oriented east-west and south-west: the coastal plain, the central plateau and the uplands. The highest points of the uplands constitute a ridge peaking at 694 metres at the 'Signal de Botrange'.

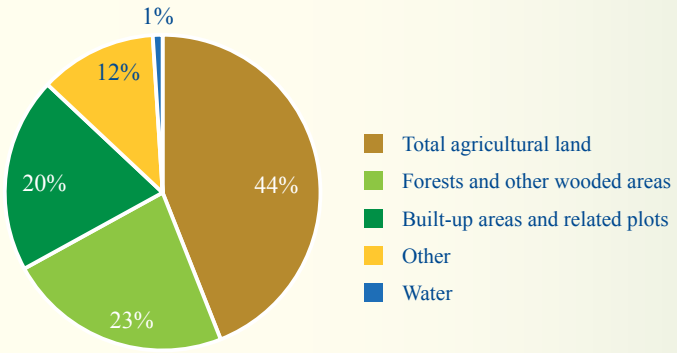
2.3.2. Ecosystems

Despite the small size of the country and its slight topographical gradient, the climate and geological conditions, together with long-standing human impact in land use, resulted in a diversity of habitats for such a small territory, many of which are of European importance (no less than 58 of them are listed in the EU Habitats Directive). The main vegetation types found in Belgium are deciduous and conifer forests, grasslands, heathlands, peat bogs, wetlands, lakes and rivers, and marine ecosystems in the North Sea. The distribution of these varies from region to region. For example, about 80 % of the forested areas are found in the southern part of the country. On the other hand, northern Belgium is noted for its semi-natural grasslands, wetlands, heathlands and coastal dunes [14].

2.3.3. Land use

Agricultural land occupies the main part of the terrestrial surface (44 %), followed by forests (23 %) and built-up areas (20 %) (Figure 2.3). Built-up areas are increasing every year, mainly at the expense of agricultural land. Forests and other wooded areas remain relatively stable.

Figure 2.3: Land use in Belgium in 2014



Source: FPS Economy – FPS Economy - Directorate-General Statistics and Economic Information [1]

2.4. Climate profile

Its latitude and the proximity of the sea warmed by the Gulf Stream give Belgium a temperate maritime climate characterised by moderate temperatures, prevailing southerly to westerly winds, abundant cloud cover and frequent precipitation. Summers are relatively cool and humid and winters relatively mild and rainy.

The temperature measurements in Belgium (Uccle) have indicated a significant upward trend since the end of the 19th century. The increase almost stops halfway through the 20th century but since then the temperature has started to increase even quicker. In recent years, the temperature shows a constant increase of 0.4 *°C per decade* [4].

The annual average temperature in Uccle is almost 2.4 °C higher in 2016 than it was in the pre-industrial period. The average temperature in all four seasons has risen, with the greatest rise being recorded in spring (Figure 2.4) [12; 13].

The year 2014 was the warmest in Brussels (Uccle) (beating the previous record of 2011) since the beginning of meteorological measurements in 1833. The 18 warmest years have occurred in the last 26 years (after 1988) [4].

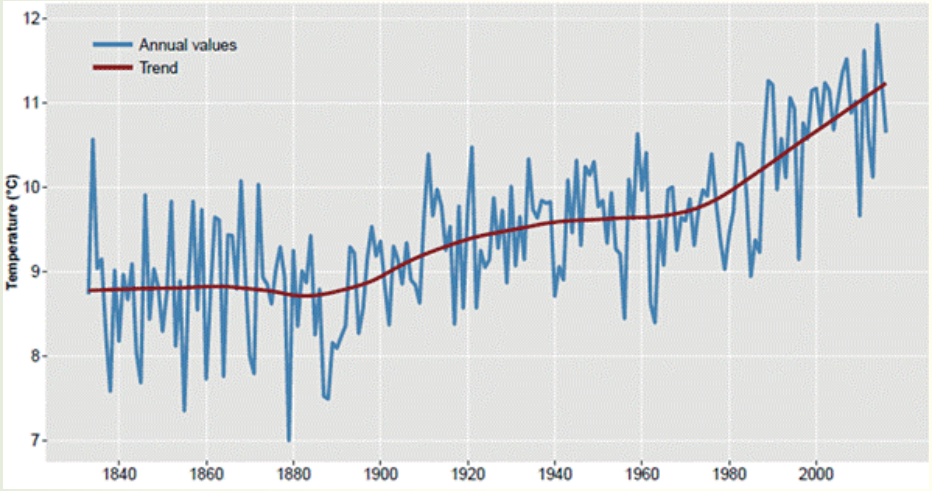
The number of heat waves and their length exhibits a wavy pattern with a first maximum in the 1940s and a clearly upward trend line since the 1970s [12].

Each decade there are 3 extra summer days ($T_{max} \geq 25$ *°C) and every two decades there is an e*xtra heat wave day ($T_{max} \geq$ *30* °C). With regard to the number of winter days ($T_{max} < 0$ *°C) and freezing days* ($T_{min} < 0$ *°C), all recorded measurements show a downward trend.* [4]

The amount of precipitation shows a very high variability over time. The annual amount of precipitation in Uccle shows a slow, but significant, rising trend. Between 1833 and the beginning of the 21st century, there was a significant increase in annual accumulations (about 7%), as well as winter and spring accumulations (approximately 15%) [4]. The number of days with heavy precipitation (1951-2013) and the maximum amount of precipitation in 5, 10 and 15 days (1880-2013) have also increased significantly [12].

For more information on observed past climate trends (heat waves, precipitation, evaporation, extreme events, etc.), we refer to Chapter 6).

Figure 2.4: Trend in average temperature (Uccle, 1833-2016)



Source: Royal Meteorological Institute of Belgium

2.5. Economic profile

The gross domestic product (GDP), the total production of goods and services, has increased constantly since 1990 (with a small drop related to the financial crisis in 2008-2009). The Belgian GDP amounted to 421.611 billion euros in 2016 (average GDP growth 2005-2015: 1.2%[1]). Although the population of Belgium only represents about 2.2% of the total European population, its GDP at market prices represents 2.8% of the GDP of the European Union [1].

Services currently make up close to 70% of the added value of the different branches of economic activity (trade, transport and horeca represent the largest share in 2015 with 25.5% of total production, followed by public administration and education with 19.3% and business services with 17.9%) [1].

Belgium has a very open economy, situated at the heart of a zone of intense economic activity. In addition, the port of Antwerp ranks second in Europe (after Rotterdam) and is one of the world's top 10. Export of goods and services represented 84.41% of the GDP in 2015 and imports nearly 82.74%, meaning that the country registered a slight profit [15]. This trade occurs in large part with the European market. Half of Belgium's export is sold to Germany, France and the Netherlands, and one fourth to other EU Member States. Imports follow more or less the same proportions. This situation reflects Belgium's role as the hub of the European Union.

Belgium also benefits from the presence of the European Commission in its capital, along with a high concentration of international agencies and service companies. Other international organisations, such as NATO, are also headquartered in Belgium.

Greenhouse gas emissions per GDP unit were 287 tonnes per billion EUR in 2015 (excl. LULUCF).

[1] Source: EUROSTAT.

2.6. Energy profile

2.6.1. Demand

Primary energy consumption [9]

The total primary energy consumption in 2015 amounted to 53.27 Mtoe. With the exception of 2014, it is the lowest level of primary energy consumption during the last decade. The technical problems in nuclear plants have caused a decrease of the consumption of nuclear energy (-22.6% compared to 2014), which was compensated by a higher import of electricity (+17.1%) and an increased consumption of natural gas (+10.1%). The share of renewable energy and waste in the primary energy consumption amounted to 8.1% in 2015 (see Table 2.1).

Energy intensity (the ratio of primary energy consumption to GDP expressed in volume) measures the quantity of energy consumed by the economy to generate one production unit. It has been following a downward trend since 1990.

The Belgian primary energy intensity is continuously higher than the European average. This can be explained by the presence of energy-intensive industries (oil refineries, cokes plants, concrete mixing plants).

Table 2.1: Primary energy consumption in Belgium in 2015 per energy source

Energy source	Mtoe	TJ	%
Oil and oil products	22.9	960 773	43
Natural gas	14.0	584 608	26
Solid fossil fuels	3.2	133 942	6
Nuclear energy	6.8	284 811	13
Renewable energy and waste	4.3	180 468	8
Other	2.0	85 707	4
Total	**53.3**	**2 230 310**	

Source: FPS Economy [9]

Final energy consumption [9]

Final energy consumption, i.e. gross apparent energy consumption after deduction of processing activities and energy loss, amounted to 43.2 Mtoe in 2015. The final energy consumption is strongly dependant on weather conditions.

In terms of market shares of total final consumption, oil products remain the dominant energy source, followed by natural gas and electricity (see Table 2.2). The shares of the different energy sources in the final energy consumption remain rather stable.

In Belgium, the residential sector is the top final consumer of primary energy (32.2%), followed by industry (25.8%) and transport (21.5%). Non-energy uses, an activity indicator for the petrochemical industry (naphtha, natural gas), also account for a substantial part of consumption (20.4%).

In the industrial sector, petroleum (17%) is clearly overtaken by natural gas, which maintained a market share of 35% in 2015 while electricity accounts for 30%.

In the residential (and equivalent) sector, natural gas remained the leading fuel in 2015 with 38% followed by petroleum (29%) and electricity (27%).

Consumption in the transport sector is dominated by petroleum products (95%). The remaining share is provided by biofuels (bioethanol and biodiesel) and electricity (railway transport). Non-energy consumption is also dominated by petroleum products (86%), completed by natural gas (12%).

Table 2.2: Final energy consumption in Belgium in 2015 per energy source

Energy source	Mtoe	TJ	%
Oil products	22.6	903 560	51.7
Natural gas	9.9	412 826	23.6
Solid fossil fuels	1.0	43 472	2.5
Electricity	7.0	294 223	16.8
Heat	0.5	21 436	1.2
Renewable energy and waste	1.7	72 009	4.1
Total	**41.7**	**1 747 526**	

Source: FPS Economy [9]

2.6.2. Offer [9]

Belgium has limited energy resources, its total primary energy production is 10.7 Mtoe (representing approximately 20% of Belgium's total primary energy consumption). Belgium is consequently highly dependent on other countries for supply.

63.7% of Belgian energy production consists of nuclear energy. The share of renewable fuels and waste amounts to 26.5%. The primary energy production on the basis of wind and sun has seen the biggest improvement since 2010 (+337.9%).

Despite the temporary closure of three important nuclear power plants (Doel 3, Doel 4 and Tihange 2), the share of nuclear amounts to 36.9% in the gross electricity production (2.24 Mtoe), followed by natural gas (32.3%, 1.96 Mtoe). The remaining production comes from renewable energy and waste, solid fuels and gasses from steelmaking processes and pumped hydro.

The use of petroleum products and solid fossil fuels has decreased strongly in favour of renewable energy and waste.

The installed capacity of nuclear power plants (5.9 GW) represents 28.0% of the total installed capacity in Belgium at the end of 2015 (21 146 MW). There are 8.5 GW of classic thermal plants, which corresponds to 40.2% of the total installed capacity.

The government has programmed the withdrawal from nuclear energy[2].

The dependency on fossil fuel imports to meet domestic demand is very high. In 2015, the ratio between net-imports and primary energy consumption was 95%. Alongside petroleum imports, the country also imports natural gas. For the last decade Belgium was a net-importer of electricity, except in 2009. Belgium has imported a record amount of 21.0 TWh (or 25.7% of the electricity consumption) in 2015.

2.6.3. Electricity and gas prices

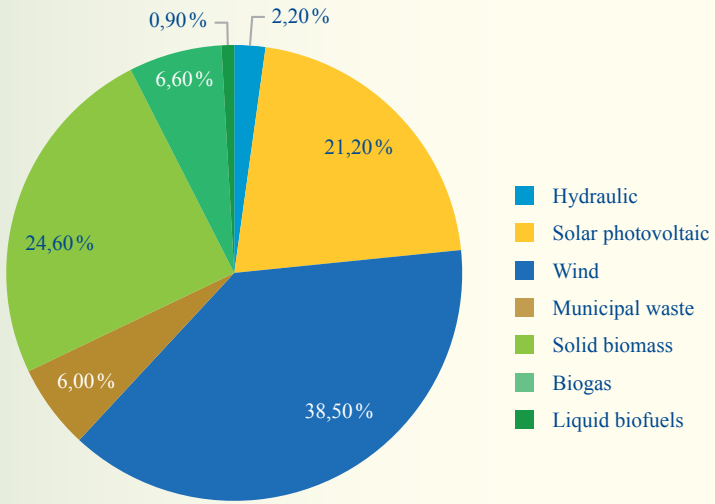
An average Belgian household paid 23.52 eurocent/kWh for its electricity in 2015 and 6.03 eurocent/kWh for its natural gas in 2015.

The energy share in electricity price represented a bit more than one third of the total electricity bill in 2015 while the network tariffs constitute almost half of the bill (42.9%)[3] and taxes represent 21% of the total bill (VAT-tariff for residential consumers increased from 6% to 21% on 1 September 2015).

[2] Law on the Phase-out of nuclear energy for industrial electricity production of 31 January 2003 (published in MB on 28 February 2003) and amended by decision of the restricted ministerial committee of 4 July 2012 on the package decisions on security of electricity supply. Following the approval of the Nuclear Safety Authority, the current government extended the long-term operation of the three oldest nuclear power plant units from 2015 to 2025.

[3] Network tariffs have risen annually since 2007 mainly due to the support mechanisms for photovoltaic installations.

Figure 2.5: Contribution of different sources to gross electricity generation from renewable sources (2015)



Source: FPS Economy, SMEs, Self-employed and Energy [9]

The average annual maximum price for oil products has dropped slightly in 2013, 2014 and 2015. This is the result of the decrease of the oil price on the international markets.

2.6.4. Renewable energy

Belgium has made progress in developing renewable energy in recent years.

In 2015, the share of renewable energy amounted to 7.88 % of total final energy consumption. The rising share of renewable energy in final energy consumption has slowed down in the last two years [9].

Directive 2009/28 of the European Union sets a target for Belgium of 13 % renewable sources in final gross energy consumption by 2020. The implementation of numerous wind turbine projects, particularly offshore, is expected to make a significant contribution to achieving this target.

The production of renewable electricity has grown strongly in the last decade.

Support programmes have helped increase the share of renewable electricity from 7.8 % in 2009 to 19 % in 2014, but green certificates systems, together with a drop in deployment costs (especially for solar PV), led to overcompensation and excess demand for installations, therefore the support levels were reduced several times by the authorities in 2012-14 [8].

The main sources of renewable electricity production are wind energy, solar energy and solid biomass. [9]

2.7. Transport

2.7.1. General description

Belgium, which is densely populated and situated at the centre of Europe, is a major centre for transit. The country's economic activity, which is strongly export-oriented, requires a dense road and rail network (one of the densest in the European Union), and also relies on inland waterways. The expansion of the intra-European area has further increased transit traffic, resulting in constant growth of transport (particularly road and air).

The consumption in the transport sector is dominated by petroleum products (95 %), it represents 59.9 % of the energy consumption of petroleum products in 2015. [9]

Road transport is the most energy-consuming means in Belgium (9 Mtoe in 2015 [9]), consuming the most energy per unit transported by km on land.

2.7.2. Passenger transport

The number of passenger cars has increased over time (from Figure 2.6). The motorisation rate remains high with 5.7 million cars for 11 million inhabitants in 2016.

Recent trends also tend to demonstrate that new technologies which serve in boosting vehicle fuel efficiency are not being developed fast enough at the moment to offset the rise in energy consumption linked to increased road traffic.

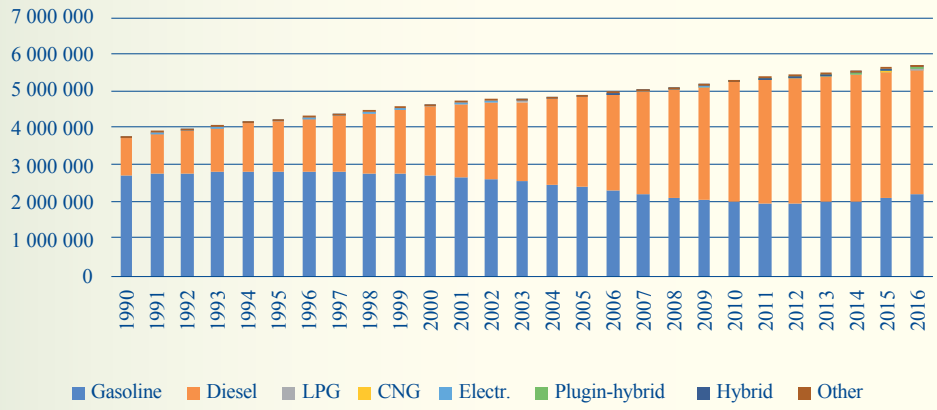
With regard to passenger kilometres travelled, cars are the main means of transport in Belgium (76.1% of all motorised mobility in 2014 were by car or motorcycle) but public modes of transport are expanding [2] (Table 2.3).

The growing saturation of roads, moreover, is leading to an increase in fuel consumption (and emissions).

As an alternative means of transport, the sale of two-wheeled motor vehicles is rising and the use of bicycles is more common in northern Belgium. While in Brussels this trend is also on the rise, it is stagnating in Wallonia.

According to the Federal Planning bureau, the number of passenger kilometres will grow by 11% between 2012 and 2030 (+21.8% for cars, +9.1% for train, -26% for bus, +0.2% for trams, +16.7% for subway, +8.7% for walk/bike, +4% for motorcycles) [2].

Figure 2.6: Evolution of total number of passenger cars registered in Belgium by fuel type (1990-2016)



Source: Federal Public Service mobility and transport

Table 2.3: Evolution of motorized road mobility in 2014

	CARs and motorbikes	PUBLIC TRANSPORT (underground, tram, bus, coaches)	RAILWAY
RELATIVE SHARE of passengers transport (in passenger km) (%) in 2014	76.1%	16.3%	7.6%
in 2000	*82%*	*11%*	*6%*

Source: Federal planning bureau (based on European Commission (2016), European transport in figures 2016)

2.7.3. Transport of goods

The road transport of goods by vehicles registered in Belgium (ton-kms of Belgian trucks carried out in Belgium and abroad) has declined since 2000 (both in terms of tonnes transported and ton-kms) [1] (cf. Table 2.4).

Road transport still accounts for most of land transport (31 808 million tkm in 2014), as it continues to be flexible, reliable and offer a competitive price, followed by inland waterways (10 451 million tkm in 2014) and rail transport (7 593 million tkm in 2014).

According to the Federal Planning bureau, the number of tonnes-kilometre/year will grow by 40 % between 2012 and 2030 (national transport) [2].

Table 2.4: Evolution of goods transport by road by Belgian trucks in Belgium and abroad

	Million tonnes km		Evolution
	(2001)	(2014)	2014/2001 (%)
Road	53 158	31 808	-40.2 %

Source: FPS Economy - Belgium statistics [1]

2.8. Industrial sector

Although Belgium's economy has become mainly based on service sectors, its industrial sector continues to be a relatively important component of Belgium's economic activity (almost 15 % of GDP). [1] Table 2.5 shows the progression of added value in the main branches of economic activity since 2007.

The sectors of industry that contribute most to greenhouse gas emissions are subdivided into three categories, according to the source of emissions:

- greenhouse gas emissions from energy combustion, mainly through the production of electricity and heat, but also from oil refining;
- greenhouse gas emissions from industrial processes, mainly from the chemical industry (petrochemicals, but also production of nitric acid and ammonia), mineral products industry (including cement and lime production) and metallurgy;
- greenhouse gas emissions from energy transformation of the manufacturing industry distributed between the iron and steel industry, the chemical industry, food and beverage processing and cement plants.

For more information, we refer to Chapter 2 of NC6 and Chapter 3 of this report.

Table 2.5: GDP – Gross added value by economic activity, estimation at current prices (in millions, gross data) [1]

					Growth	
	2007	2013	2014	2015	2015/2007	2015/2014
Agriculture, forestry, fishery	3 048	2 781	2 518	2 257	-26.0 %	-10.4 %
Industry	60 811	58 521	59 048	59 819	-0.6 %	1.3 %
Construction	16 698	19 490	20 319	20 549	23.0 %	1.1 %
Services	227 738	270 479	270 479	283 682	24.4 %	2.7 %
Other components	36 774	41 405	42 243	43 101	17.3 %	2.0 %
GDP at market price	345 069	392 675	400 408	409 407	18.8 %	2.2 %

Source: FPS Economy - Belgium statistics [1]

2.9. Waste

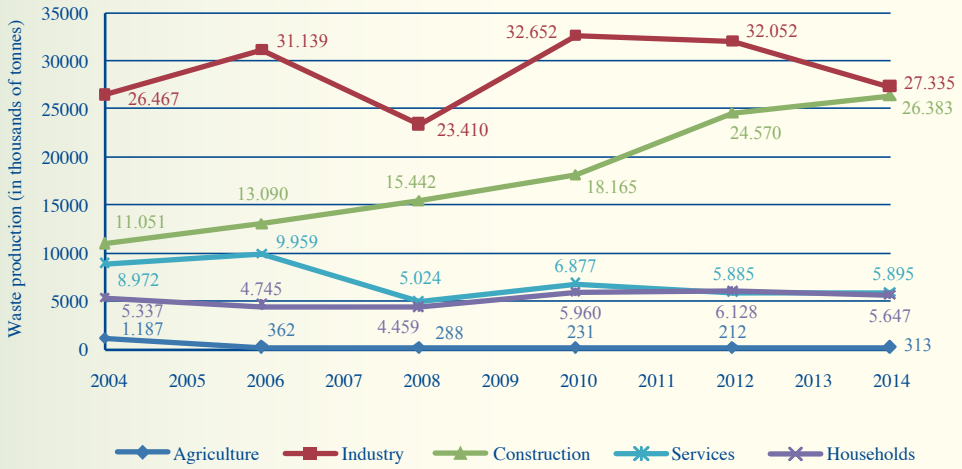
Overall, waste generated in Belgium rose to 65 573 thousand tonnes (2014), a 24 % increase compared to 2004[4]. The major waste producers are industry (41.7 %) and construction (40.2 %) (cf. Figure 2.7).

[4] 'Waste' means any substance or object which the holder discards or intends or is required to discard (art. 3 of EU directive 2008/98/EC on waste and repealing certain Directives).

The quantity of municipal waste has increased until 2007. From 2007 to 2015, this figure dropped by 15 % (Figure 2.8).

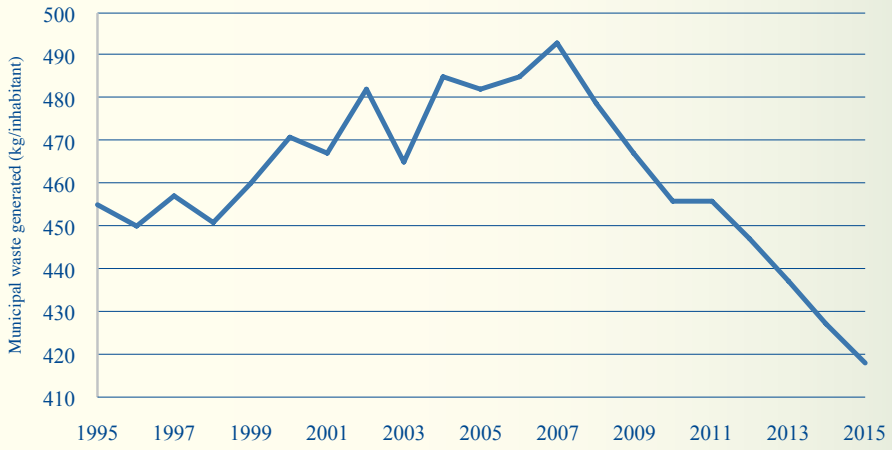
Significant improvements in waste treatment have helped to sharply reduce the amount of waste put into landfills. The distribution between the different waste treatment methods remains stable these last years (Figure 2.9). The problem of reducing waste production remains a priority issue for the authorities.

Figure 2.7: Waste production by economic activity (2004-2014)



Source: Belgium statistics on surveys and administrative sources (OVAM (Public Waste Agency of Flanders), IBGE-BIM (Brussels Institute for the Management of the Environment), DGARNE (Directorate-General Agriculture, Natural Resources and the Environment) and models. Additional data and information: Eurostat

Figure 2.8: Evolution of the quantity of municipal waste generated per inhabitant (1995-2015)



Source: Eurostat

2.10. Housing stock [1, 7]

Belgium counted 4 472 925 buildings in January 2015. Since 1995, the number of buildings has increased by 12 %. Over the same period, the number of dwellings increased by 20 % (5 318 905 units). The Belgian housing stock remains old. The age of the buildings varies from one region to another. In Flanders, 29.6 % of the buildings were built after 1981, compared with 19.5 % in Wallonia and only 6.2 % in the Brussels-Capital Region.

In 2016, 77.7 % of households lived in a single-family house and 21.9 % in a flat (source: EUROSTAT).

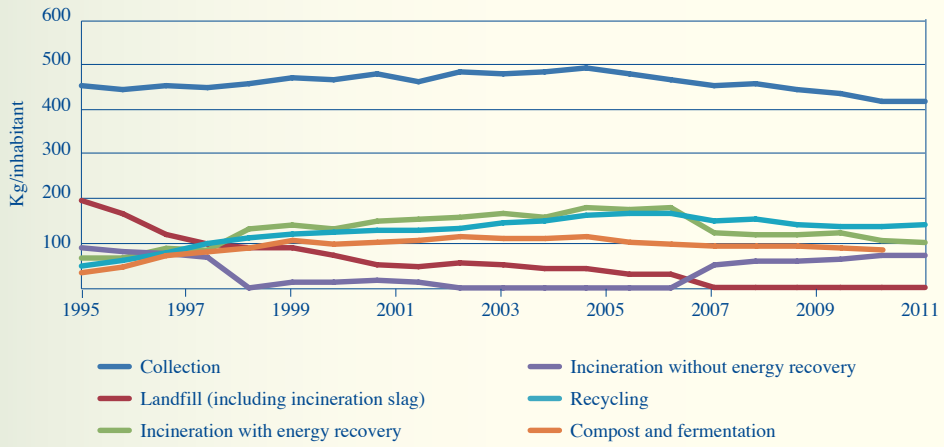
More than 80 % of households have central heating. The main heating source in Belgium is natural gas.

In addition to heating, a significant amount of energy is also consumed by domestic appliances. For a detailed overview of these appliances we refer to NC6 (Table 2.18).

Private households spent on average 29 % of their budget for housing in 2014, of which 5 % is spent for gas (2 %), electricity (2 %) and other fuels (1 %).

Almost 8 % of households have photovoltaic panels at home.

Figure 2.9: Distribution of municipal waste treatment methods



Source: Belgium statistics based on surveys and administrative sources

2.11. Agriculture and forestry [1, 5]

Agriculture in Belgium, favoured by fertile soil and a temperate climate, is specialised in market garden and horticultural crops, cereals, potatoes, sugar beets, stock farming and milk production. Due to the short coastline, fishing has relatively limited importance as an economic activity. Although farmland covers most of Belgium (44% of the territory), its surface area is shrinking and giving way to buildings.

The share of agriculture in the Belgian economy, which was already very low, continues its decline and is now less than 1% of GDP. But if we associate the food industry, the place of the agro-food sector becomes much more important. Moreover, the relative share of the agro-food sector is also much higher in exports (up to 11.2% in 2014).

The major characteristic of the Belgian agricultural sector is the structural reduction of the number of farms (36 910 in 2016). As the total area of all farms decreases less rapidly, the average surface area per farm is growing (it has almost tripled in 35 years).

Organic farming is developing quickly in terms of surface area and number of farms (between 2010 and 2016, the average annual growth rate of the number of organic farms was 9.1%) (Table 2.6). There is also a very high increase in the number of certified organic cattle.

Despite a high population density, forests and other natural areas remain relatively stable (23% of the territory). The distribution of forests in Belgium is shown in Table 2.7. ■

Table 2.6: Number of farms, surface area (km²) and number of cattle in organic farming for the 1987-2014 period in Belgium

	1987	1997	2010	2011	2012	2013	2014	2015	2016
Number of organic farms	109	291	1 140	1 262	1 389	1 487	1 630	1 717	1 923
Surface area (km²)	10	68.2	487	546.1	596.8	624.7	666.9	687.8	782.5
Number of cattle			64 009	69 076	72 487	76 214	76 443	80 269	88 682

Source: FPS Economy Belgium statistics

Table 2.7: Forest cover in Belgium (2015)

	Total area (km²)	Forest area (km²)		Forest cover (%)	% total forest area
		Forest	Other wooded land		
Wallonia	16 844	5 259	322	33.1	77.8
Flanders	13 522	1 558	15	11.6	21.9
Brussels-Capital	162	17	0	10.5	0.2
Belgium	30 528	6 830	360	23.5	100.0

Sources: FAO [11]

References

[1] *Chiffres-clés 2016, Aperçu statistique de la Belgique (Key figures 2016, Statistical overview of Belgium) – FPS Economy - Directorate-General Statistics and Economic Information)*

[2] *Indicators complementary to GDP - Federal planning bureau* http://www.indicators.be/

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[6] *Comptes nationaux* – Comptes financiers trimestriels: 3e trimestre 2016 – National Accounts Institute, National Bank of Belgium ISSN 1780-4388 online)

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[12] *MIRA Climate Report 2015*, Vlaamse Milieumaatschappij (Flemish Environment Agency)

[13] *MIRA Climate Change indicator*s on www.milieurapport.be/en/facts-figures/environmental-themes/climate-change/

[14] *Fifth National Report of Belgium to the Convention on Biological Diversity*, 2014 https://www.cbd.int/doc/world/be/be-nr-05-en.doc

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3. Greenhouse gas inventory information

3.1 Summary tables

Inventory information presented in this chapter[1] is extracted from the 2017[2] submission following the UNFCCC recommendations (Annotated Outline for Fifth National Communications of Annex I Parties under the UNFCCC, including Reporting Elements under the Kyoto Protocol). This inventory includes emissions data for the years 1990 to 2015.

Evolution of GHG emissions and removals as well as GHG emissions and removals in the main sectors from 1990 to 2015 are provided in CTF Table 1.

[1] Expressed as CO_2 equivalents, i.e. taking into account the overall warming effect of each of the gases, which is used to evaluate the relative contribution to global warming of the emission in the atmosphere of a kg of specific greenhouse gas, as opposed to the emission of a kg of CO_2 and taking into account their life spans and their respective radiation powers (CO_2= 1, CH_4 = 25 and N_2O = 298). A kg of CH_4 therefore has the same effect as 25kg of CO_2 over a 100 year period.

[2] The data correspond to the submission of April 2017.

3.2 Analysis of trends

3.2.1 General trends

Total greenhouse gas emissions (without LULUCF) in Belgium amounted to 117.4Mt eq. CO_2 in 2015 (CTF Table 1) and to 115.5 Mt eq. CO_2 (with LULUCF). This represents a decrease of -19.7% compared to 1990 and -20.7% compared to Base year emissions (with 1995 for F-gases).

The major greenhouse gas in Belgium is carbon dioxide (CO_2), which accounted for 85.4% of total GHG emissions in 2015. Methane (CH_4) accounts for 6.9%, nitrous oxide (N_2O) for 5.1%, and fluorinated gases for 2.7% (Figure 3.2). Emissions of CO_2 decreased by 16.6% during 1990-2015, while CH_4, N_2O and fluorinated gas emissions have dropped with respectively 33.9%, 41.2% and 43.2%[3] during the same period.

An overview of the contribution of the main sectors to Belgium greenhouse gas emissions is given in Figure 3.3. Manufacturing industry, energy industries, transport and space heating (residential) are the most important sectors in the total GHG emissions in 2015.

"Others" includes "Fugitive Emissions from Fuels", "Other Combustion" and

[3] Compared to 1995 emissions

Figure 3.1: Belgium GHG emissions 1990-2015 (excl. LULUCF). Unit: Index point (base year emissions = 100). For the fluorinated gases, the base year is 1995

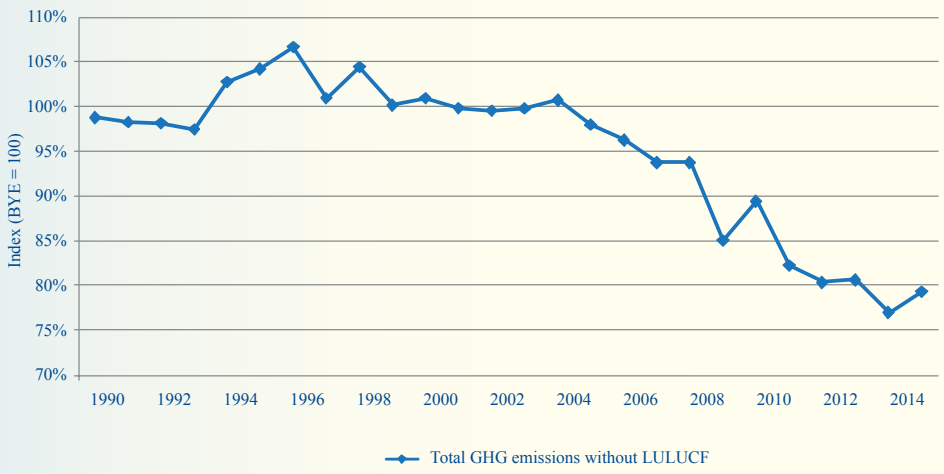


Figure 3.2: Share of greenhouse gases in Belgium (2015)

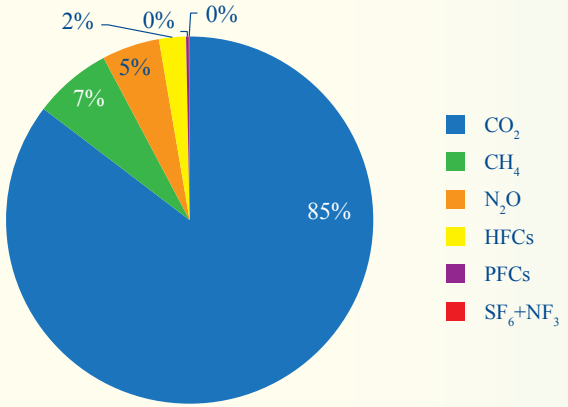


Figure 3.3: Share of the main sectors in 2015

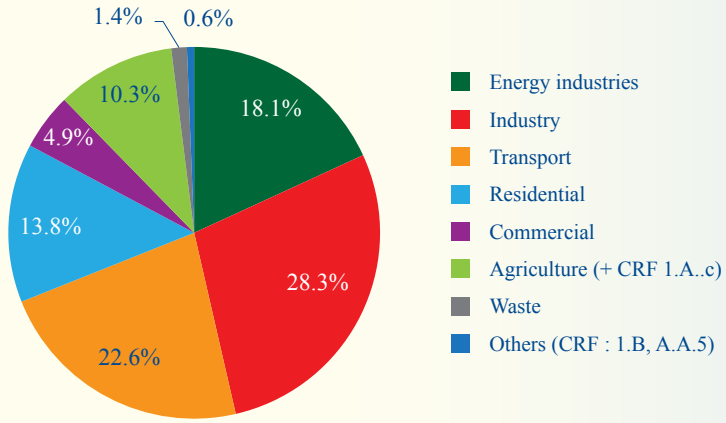
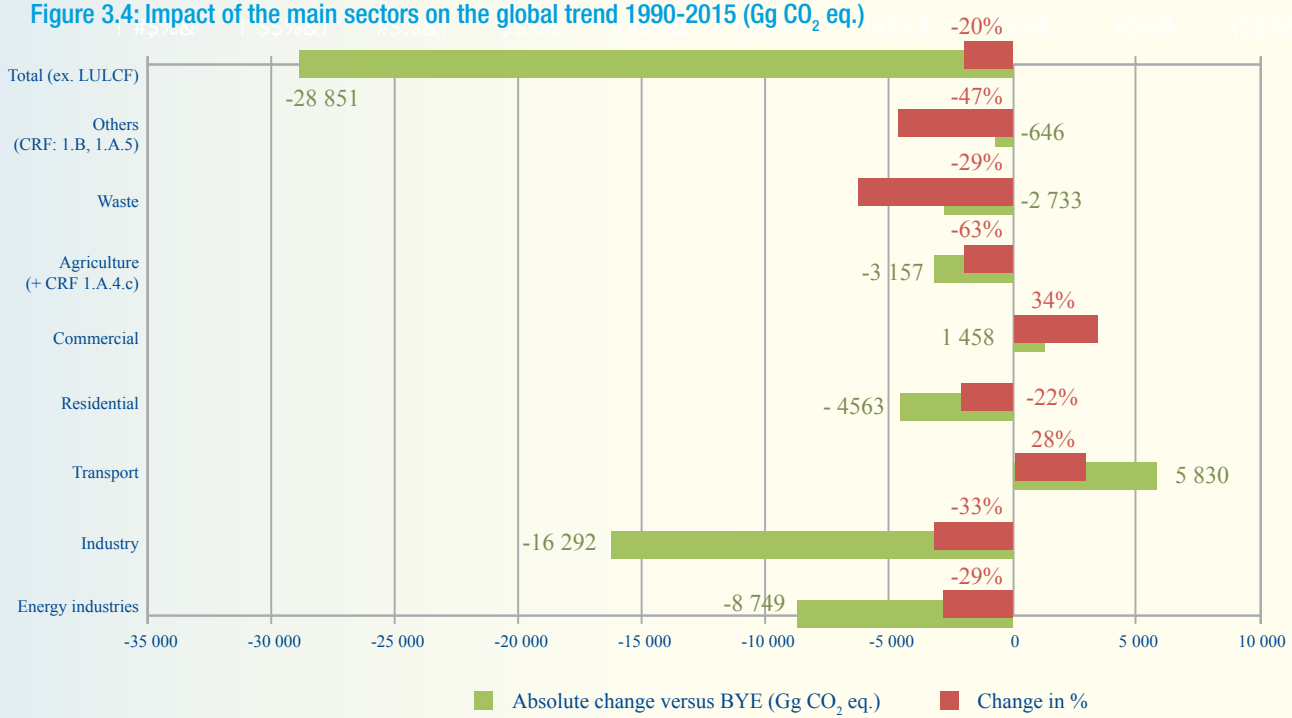


Table 3.1: Total GHG emissions for Belgium (excluding LULUCF) in 2015 with the respective verified emissions reported by installations and operators under Directive 2003/87/EC (Emission Trading Scheme)

	2015 emission in Gg CO_2-eq
ETS emissions (Directive 2003/87/EC)	44 714
ESD emissions (Decision 406/2009/EC)	72 719
Other (NF_3 and CRF 1A3a Domestic aviation)	10
Total emissions without LULUCF	117 443

Figure 3.4: Impact of the main sectors on the global trend 1990-2015 (Gg CO_2 eq.)



"Solvent and Other Product Use". Combustion of agriculture are included in "Agriculture" sector.

Figure 3.4 summarises the impact of the main sectors on the national trend. It clearly shows the sharp increase in road transport on the one hand but also the increase of emissions from buildings in the commercial sector on the other hand. Since 1990, those two sectors together grew by 29% and have been responsible for a 6.2% increase in total emissions. In 2015, the residential sector has emisisons increased slightly compared to 2014 (2014 is currently the mildest year observed in Belgium). Emissions in 2014 were the lowest for all the time series.

This trend is counterbalanced by the 26.9% decrease in emissions in the other sectors, particularly manufacturing industry (combustions & process recorded a 32.9% decrease since 1990 explaining 13.9% of decrease in total emissions) and energy industries (emissions recorded a 29.1% decrease since 1990 explaining 7.4% of decrease in total emissions).

The drivers of these trends are analysed and commented on the following pages, sector by sector.

"Others" includes "Fugitive Emissions from Fuels", "Other Combustion" and "Solvent and Other Product Use". Combustion of agriculture are included in "Agriculture" sector.

The split between emissions reported under the Effort Sharing Decision (EC/406/2009) and emissions covered by the Emission trading Scheme (Directive EC/2003/87) is presented in Table 3.1.

3.2.2 Energy production

The main source for this sector is public electricity and heat generation (1A1a), which accounted for 78 % of sectoral emissions in 2015. Petroleum refining (1A1b) and manufacture of solid fuels (1A1c) accounted for 22.5 % and 1 % respectively.

Emissions from the manufacturing of solid fuels have decreased by more than 93 % since 1990 (-1 884 Gg CO_2 equivalent) due to the closure of six coke plants in 1993, 1995, 1997, 2000, 2005 and 2010. In 2015, emissions from petroleum refining are 7 % higher as compared to 1990. Emissions in this sector can fluctuate depending on the general economic context and planned shut-down for inspection - maintenance- and renovation works. This was the case in 2011 for one of the biggest refineries.

As mentioned above, the main driver in this sector is still public electricity and heat generation although the sector is experiencing a sharp decline since 2010. While electricity and heat production have risen by 39 % between 1990 and 2014, emissions have decreased (-30 %) due to technological improvements, increase of the number of combined heat-power installations and the switch from solid fuels (coal) to gaseous fuels (natural gas) and renewable fuels. This is illustrated in Figure 3.5.

Figure 3.5: GHG emissions from public electricity and heat generation, in relation to gross electricity generation (excluding nuclear) [1]

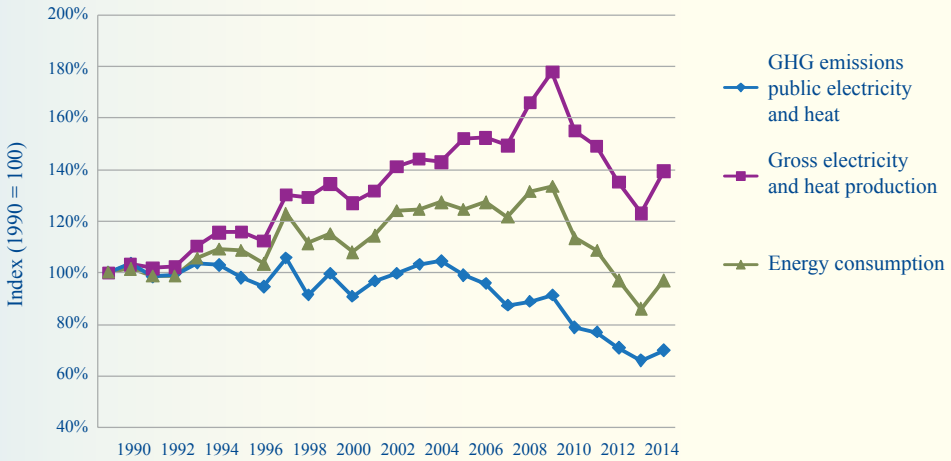
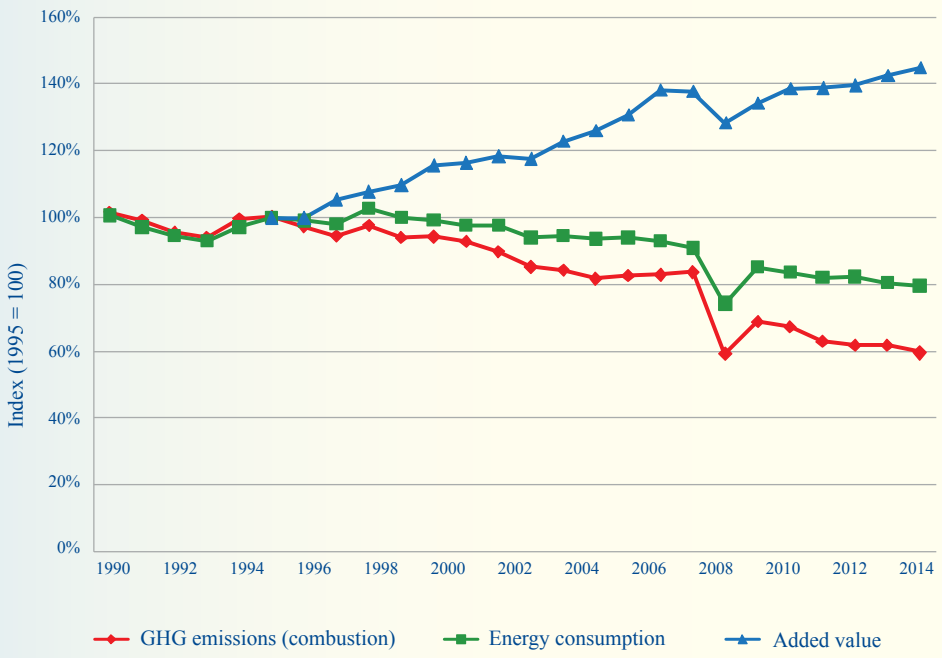


Figure 3.6: Manufacturing industries: index of GHG emissions, energy consumption and added value [2]



3.2.3 Manufacturing industries

In the manufacturing industries, added value[4] has increased by 45% in 2015 since 1995, while greenhouse gas emissions (combustions) decreased by 40% in the same period (only emissions from combustion are considered here).

As illustrated in Figure 3.6, fuel energy consumption decreased by 21% between 1990 and 2015 (and by 26% if we consider 2009). This strong decrease is obviously due to the impact of the economic crisis in the iron and steel sector. The apparent **decoupling of added value and energy consumption** can be attributed to various drivers according to sectors.

In the iron and steel industry, many plants have switched to electric furnaces since 1990. For example, the share of iron and steel plants using electricity increased from 9% in 1990 to 35% in 2011. This is the main cause of the apparent decreasing energy consumption, while stable added value is observed in this sector. Because of the re-allocation between the energetic and the process emissions in the iron & steel sector since the 2015 submission, this sector represents now only 8% of the energy consumption through combustions in 2014 by the manufacturing industries and consequently its impact on the global trend has decreased.

In the chemical sector, fuel consumption (non-energy use of fuels are excluded) has decreased by 10% between 1990 and 2006, compared to 65% added value growth [1]. This major decoupling is linked to both rational energy use and high added-value products. In 2014, this sector represents 24% of energy consumption in the manufacturing industries.

Food processing and beverages represented 11.6% of energy consumption in the manufacturing industries in 2006, but 13 to 14% of added value [1]. The diversity of the plants in this sector does not allow a detailed analysis of the trend; only certain types of plants are commented upon here. In sugar plants, for example, some products with high added value, such as inulin and fructose, have been developed but the main driver is still the sugar beet yield (quantity and sugar content), which is highly climate-dependent.

In cement plants, the decoupling between energy consumption and total production is linked to the production process: the dry process, which is considerably less energy-demanding, is gradually replacing the wet process and is now (2015) used for 78% of clinkers production compared to 61% in 1990.

Figure 3.6 also shows a decrease in greenhouse gas emissions for an equal level of energy consumption. One reason is the increasing use of gaseous fuels, coupled with a decrease in liquid and solid

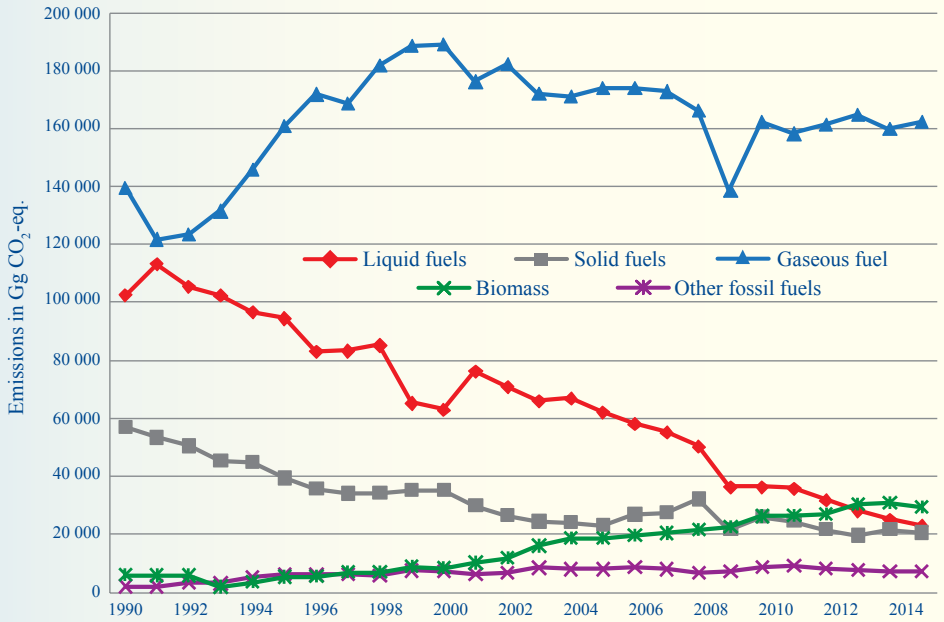
[4] Gross added value of sector 1A2, estimates in chained EUR (reference year 2005) - Federal Planning Bureau

fuels observed across all sectors. This is illustrated in Figure 3.7.

The increasing use of 'other fuels' reflects that cement plants have been using more and more substitute fuels since 1990, such as impregnated sawmills, animal waste, tyres, etc. Those fuels represented 51% of their energy consumption in 2015 compared to 8% in 1990. The non-biomass fraction of these fuels is included in the 'other fuels' category. The biomass fraction of these fuels is included in biomass fuels; therefore the CO_2 emissions are not accounted for in the national emissions.

Half of the biomass fuels used in Belgium comes from the pulp and paper sector, where part of the woody raw material has always been used as fuel in pulp paper plants. The consumption increased by 288% from 1990 to 2014 in this sector while the increase is multiplied by almost 5 for all the manufacturing industries reflecting the development of this fuel since the 2000s.

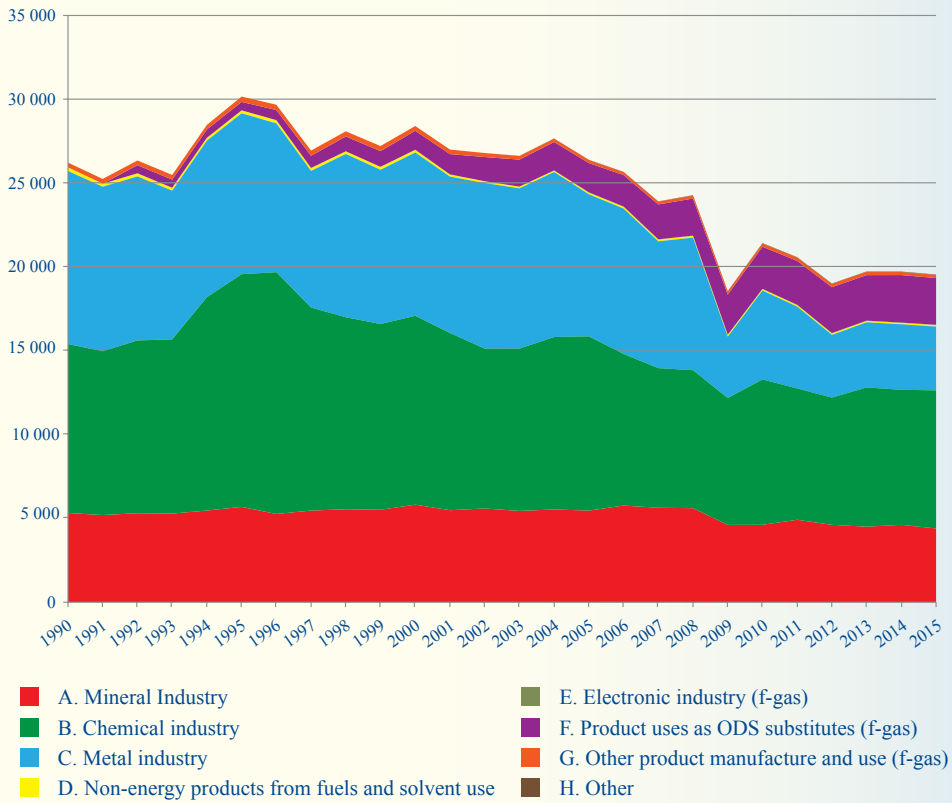
Figure 3.7: Type of fuels used in the manufacturing industries



3.2.4 Industrial processes

The 'industrial processes and F-gases' sector covers emissions from industrial activity, but not resulting from fossil fuel combustion. In 2015, these emissions of greenhouse gases were mainly caused by the chemical industry (42% of emissions of which 57% just for the petrochemical industry and 5% for nitric acid and 17% for ammonia production), the mineral products (22.5% of emissions of which 53% for cement and 38% for lime pro-

Figure 3.8: Greenhouse gas emissions in the industrial processes sector (Gg CO_2-eq)



duction), the metal production (19.5% of emissions - sharply down since 2009 due to economic crisis). Besides 14.5% of these emissions are caused by the 'product uses as ODS substitutes'.

3.2.4.1 Mineral products

These emissions occur during the production of clinkers, lime and glass (decarbonation of calcium carbonates) and are closely linked to production levels, which are stable on the whole.

3.2.4.2 Chemicals

Despite the closure of two nitric acid plants (one in 1995 and another in 2000), the production of nitric acid in the two remaining plants increased by 42% in 2015 compared to 1990 (after a sharp decline in 2009). In parallel, these plants have taken measures to reduce emissions from their processes (use of catalysts since 2003 with a drop of the emissions in 2011 after introducting new catalysts on two installations at the end of 2010, emissions were reduced by 89%).

Due to a re-allocation of emissions of CO_2 from 1A2c/other fuels to category 2B8b, emissions of CO_2 become predominant. These emissions are the recovered fuels in the steamcracking units in the petrochemical industry, and others recovered in the chemical industry.

3.2.4.3 Metal production

In the iron and steel sector, greenhouse gas emissions decreased by 63% in 2015 compared to 1990. This is in line with the economic crisis that has hit the iron and steel sector in 2009 with a decrease in activity of almost 50% in all sub-sectors.

3.2.4.4 Fluorinated gases

Emissions of fluorinated gases accounted for 2.7% of total greenhouse gas emissions without LULUCF in 2015. A distinction is made between 'production emissions', which are fugitive emissions during the production process, and 'consumption emissions', which are those occurring during the use or dismantling of existing equipment and products.

The sharp decrease in emissions from the production of HFC between 1996 and 1999 is due to the installation of a gas incinerator with an HF recovery unit (Fluoride Recuperation Unit) in the most important source identified, which is an electrochemical synthesis unit located in the Flemish region.

The growing consumption of HFC is directly linked to the implementation of the Montreal Protocol and EU Regulation 1005/2009, which bans the use of ozone-depleting substances such as CFCs and HCFCs. The CFCs and HCFCs which were formerly used are now being replaced by HFCs in most sectors like refrigerating and air conditioning installations, foam production and aerosols. The quantities are now also controlled at the EU level as well as in other major industrialized countries. Recently, the Montreal Protocol has been mandated to manage this problem through the Kigali Amendment. Calendars of reduction have been agreed upon, as well as financial support for the developing countries. The industry starts proposing fluorinated alternative with much lower impact on the environment but other solutions using natural refrigerants (ammonia, hydrocarbons and cardon dioxide) are rapidly developing and enhancing.

Many SF_6 uses are now banned under the EU regulation but the major use remaining is the insulation of high voltage switchgear (electricity transport and distribution). However, SF_6 consumption emissions are likely to increase in the coming years due to the dismantling of existing equipment outside Europe.

3.2.5 Residential and commercial

In the residential sector, fuel consumption has increased by 16% between 1990 and 2003. This is mainly linked to the increasing number of dwellings (+26% between 1991 and 2001) since these two years were very similar from a climatic point of view. Annual fluctuations are of course climate-related with degree days[5], one of the key parameters used to analyse the sector energy consumption. This is particularly clear for 1996 and 2010 which were cold years with a marked peak of emissions from heating, but also for 2007, 2011 and 2014, three years with exceptionally mild winters, which caused a sharp drop in consumption. Recently, rising energy prices and improving building insulation have probably also contributed to consumption reductions. Since 1990, gaseous fuels consumption has increased in the residential sector (stationary combustion) from 34 to 50% of total energy consumption (without electricity and heat), together with a decrease in solid fuels and liquid fuels (this is probably explained by a combined effect of price and policy measures promoting gas). Liquid fuels still account for 41%, however. One explanation is that the gas distribution network does not cover sparsely populated areas, thus hampering the switch from liquid to gaseous fuels, which is observed in other sectors.

In the commercial and institutional sector, fuel consumption has increased by 48% since 1990. Annual fluctuations are also climate-related but the overall trend is less affected than in the residential sector. One reason is the rising number of employees, which has risen by 29% (between 1993 and 2014). In the meantime, electricity consumption has also grown by 94% (between 1990 and 2013), mainly due to the development of Information

[5] Degree day: the difference expressed in degrees centigrade between the average daytime temperature and a base temperature (15 °C for the 15/15 base and 16.5 °C for the 16.5/16.5 base). Average temperatures that are higher than the base temperature are not included. The total number of degree days over a given period (month or year, for example) are added together. Degree days enable heating requirements to be assessed.

Technologies and the increased use of refrigerated areas and air conditioning. The emissions from this final consumption of electricity are included in the energy sector emissions. These increases have been partially counterbalanced by a clear switch from liquid fuels to gaseous fuels observed since 1995 and natural gas represent now 75 % of the sector's energy consumption (without electricity and heat).

For both sectors, other fuels and biomass were negligible but according a new estimation of consumption of biomass fuels in the residential sector, biomass represents now 8 %. In the commercial sector, a slow increase has been observed since 1998, but biomass represents only 3.5 % of the sector's energy consumption (stationary combustion). The switch from solid and liquid fuels is reflected in the decoupling of energy consumption and GHG emissions (Figure 3.9).

Figure 3.9: Residential and commercial sector: GHG emissions index and Consumption Index (1990 = 100)

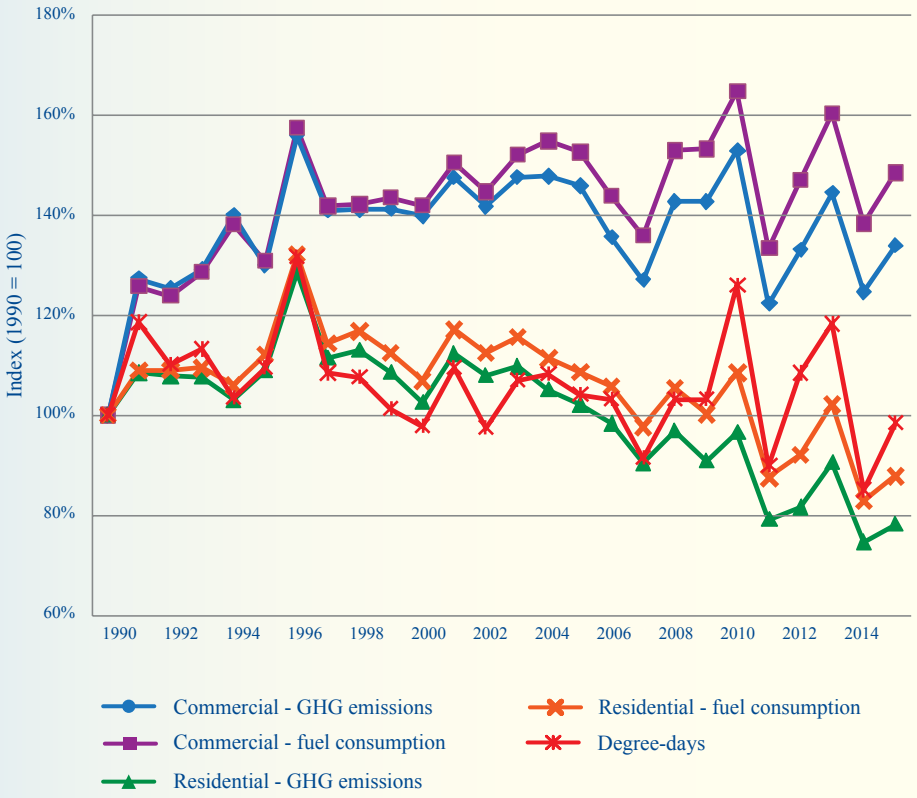
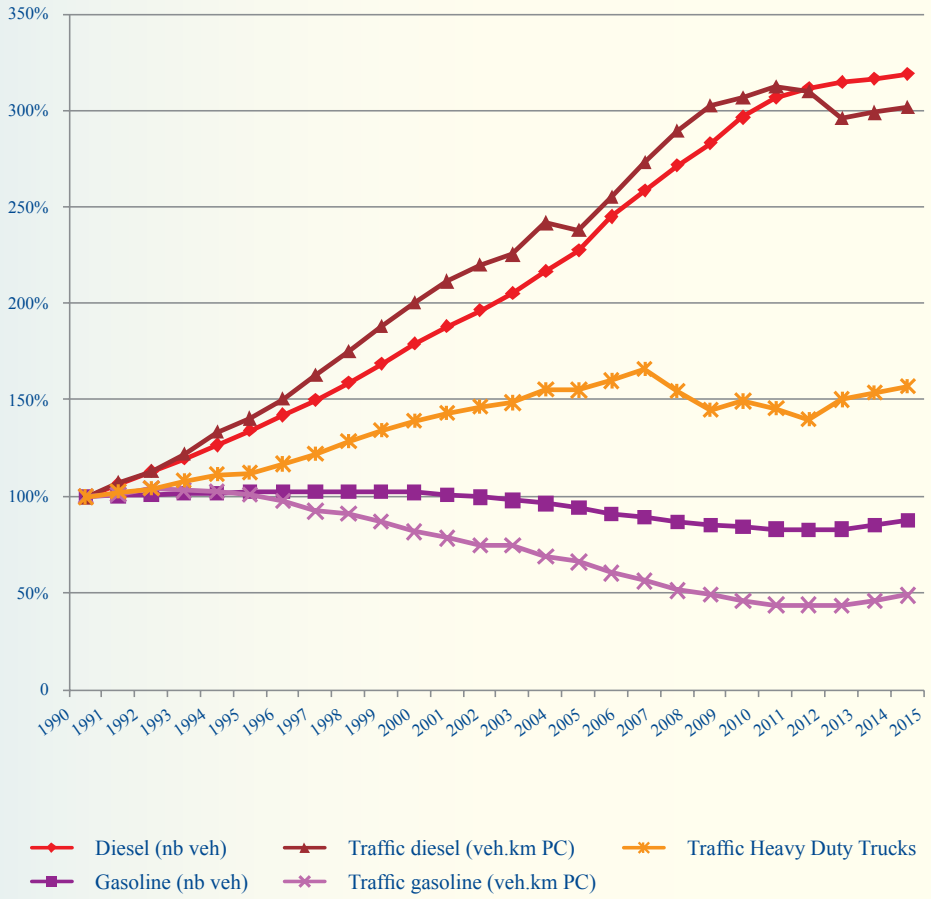


Figure 3.10: Road transport emissions (according to "reference approach") and traffic index (index: 1990 = 100 %)



3.2.6 Transport

Transport emissions accounted for 14.1 % of total GHG emissions in 1990 and 22.6 % in 2015. This increasing share is due to road transport, which represents 97.5 % of total emissions by the sector in 2015.

Emissions from domestic navigation are fairly stable and represent almost 1.5 % of transport total emissions in 2015. Emissions from railways (0.3 % in 2015) seem to have decreased since 1990, but in fact this reflects the switch from diesel to electrical engines.

In the road transport sector, most indicators are increasing (2015): the number of vehicles has increased by 54 % since 1990 (48 % for passenger cars alone), together with traffic (vehicle km) which has risen in the meantime by 54 %. During quite the same period, the road freight traffic[6] grew by 82 % (ton-kilometer-2012) while the number of passengers carried by cars increased by only 27 %.

There is a marked switch from petrol engines to diesel. The number of petrol engines (all vehicles) has dropped between 1990 and 2015 (-12 %) while the number of diesel engines has tripled (+ 319 %) on the same lapse of time. This is reflected in their respective traffic figures for personal car (- 23 % for petrol engines and +368 % for diesel engines) and in their respective emissions as well (Figure 3.10). However in 2016 the number of diesel cars has decreased by 68 000 units while the number of petrol cars has increased by 120 000 units (source: FPS mobility and transport).

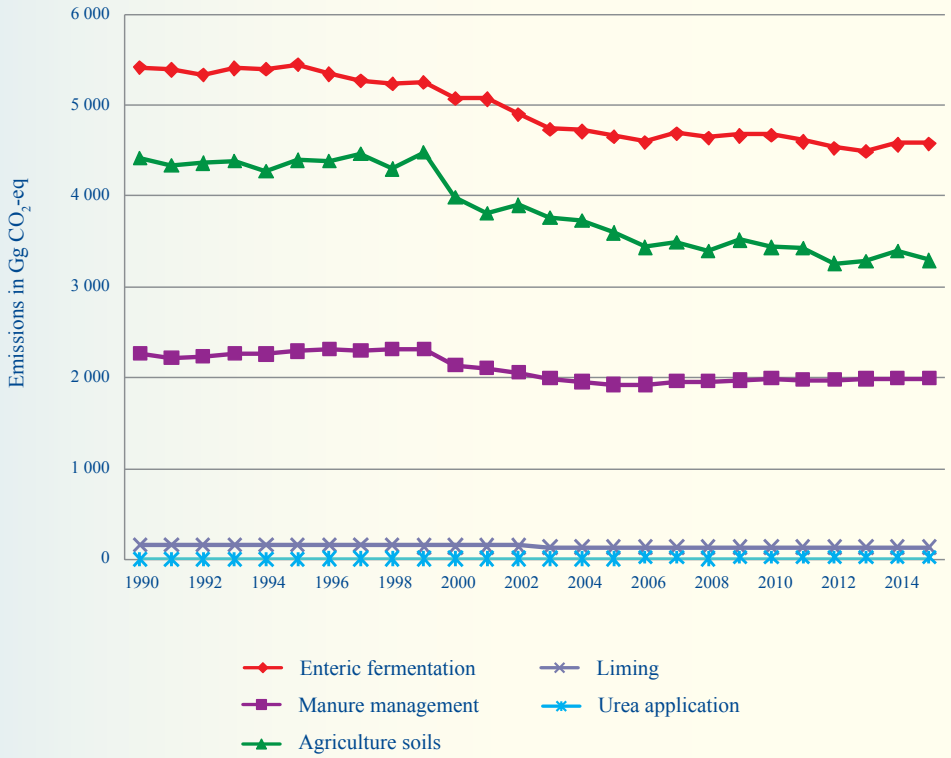
The average engine capacity has also increased since 1995, reflecting the switch to diesel on the one hand and the growing success of Sport Utility Vehicles and Multi-Purpose Vehicles on the other. The average age of the cars has increased (improved rust protection and overall resistance), as has the average distance travelled which is now being stabilized.

The number of vehicles using LPG has increased by 36 % between 1990 and 2002 and then decreased by 75 % and is representing now in 2015 a decrease of 66 % over 1990. The progress encountered during the early 2000s (thanks to subsidies and best prices) have now completely disappeared. Private cars using LPG represent only 0.26 % of total private cars in 2015 whereas it was 1.65 % in 1987.

Road transport is one of the key sources of greenhouse gas emissions in Belgium, in terms of level and trend analysis. With an increase of GHG emissions by 23 % between 1990 and 2015, it constitutes one of the main drivers of emissions trends. The absolute increase in CO_2 emissions from road transport between 1990 and 2015 is the second highest among the key sources for the trend assessment (+4 794 Gg CO_2).

[6] Road freight traffic of Belgian and foreign trucks carried out in Belgium

Figure 3.11: Emission trends in the agricultural sector (Gg CO_2-eq)



International air and maritime transport

In accordance with the UNFCCC guidelines, emissions from international air and maritime transport are not included in national emissions. In 2015, these emissions represent 19% of national emissions, with maritime transport representing the most important source (82% of this category). Emissions from international aviation have increased by 68% since 1990, while emissions from maritime transport have risen by 35% (135% of increase in 2008 since 1990 en then going down since 2009 due to the economic crisis).

3.2.7 Agriculture

GHG emissions from agriculture (without fuels used) account in 2015 for 8.5% of the total emissions in Belgium. Overall (including emissions from energy sector 1A4c), they have decreased by 21.3% between 1990 and 2015.

45.0% of these emissions (without fuel used) are CH_4 emissions from enteric fermentation (category 3A) in 2013, cattle are responsible for 93% of these emissions. As can be seen in Figure 3.11 those (direct) emissions decreased by 16% since 1990. This is mainly due to a general livestock reduction, but also to the shift from dairy cattle to brood cattle (which is a general EU trend linked to the Common Agriculture Policy), the latter having smaller emissions.

20% of the emissions are emissions from manure management in 2015 of which swine accounts for the biggest part (58%). These emissions are driven by the livestock: the swine livestock is rising from 1990 until 1999 and decreasing since then, its impact on the emissions being smoothed by the cattle livestock evolution explained above.

33.7% of the emissions in the agriculture are originating from N_2O emissions from soils. Those have decreased by 24%, due to the smaller quantities of nitrogen from mineral fertiliser applied on the one hand and to the livestock reduction (nitrogen excreted on pasture and from organic fertiliser applied) on the other. Both reductions have also an impact on indirect emissions. Agricultural soils can also be a carbon sink: this is the case for grasslands, but not for cropland, as presented in Section 3.2.8 and Figure 3.12.

3.2.8 Land-use, land-use change and forestry

As illustrated in Figure 3.12, forests in Belgium are a major sink of carbon rather stable over time which gives the trend on LULUCF sector. The level of this sink is related to some methodological aspects in carbon stock change. Grasslands are also a sink. This is in line with the new data available for carbon stock in soils.

The area of settlements increased steadily since 1990. Increased urbanized areas explain this growth and the conversion from lands to settlements provoke emissions from carbon stock in soils. The trends in cropland and grassland are maily linked to land-use changes observed since 1990. “Other lands” are no longer present in the trend assessment as they were reclassified, in response to recommendation by the ERT.

The result of these evolutions generates negative net emissions fairly stable for the whole LULUCF in Belgium, in the range of -2 500 Gg eq. CO_2.

Emissions of N_2O and CH_4 increase steadily from 2-3 % in 1990 to about 14 % of total sector sources mainly because of Direct N_2O Emissions from nitrogen mineralization/immobilization (except in 1996 with 34.5 % and 2011 with 20.3 % due to large forest fires).

Figure 3.12: Emission and removal trends in LULUCF sector

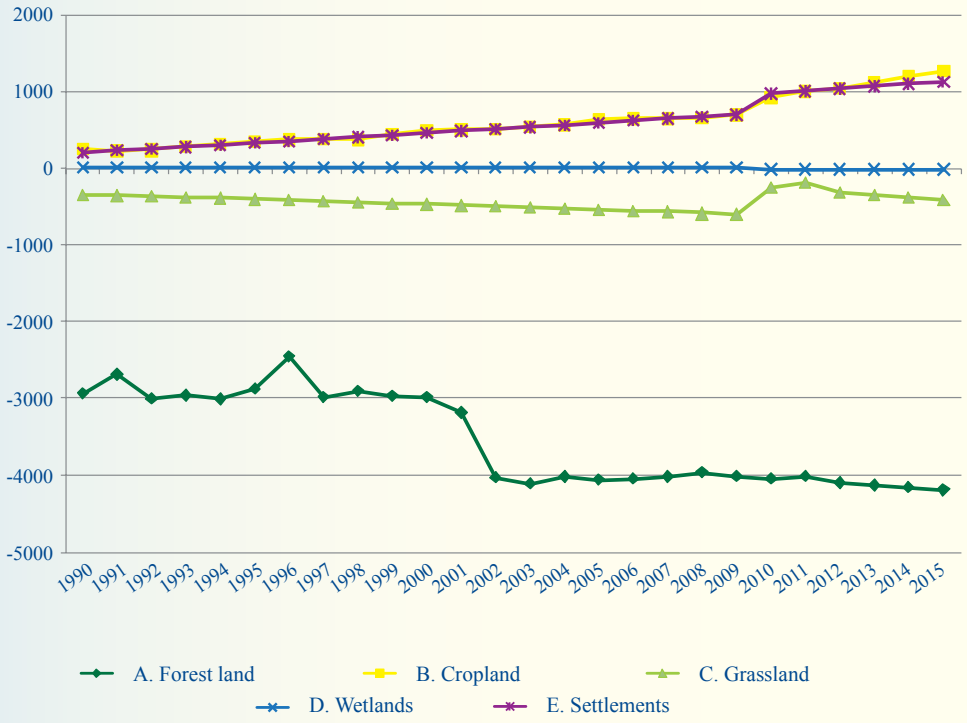
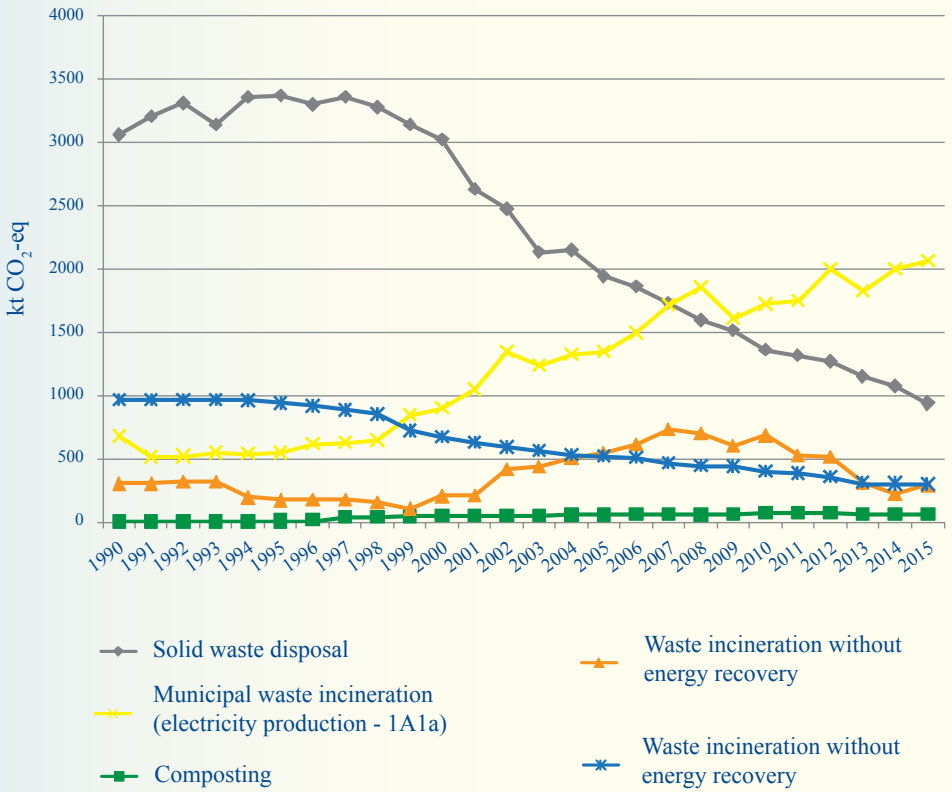


Figure 3.13: Emission trends (1990-2015) in the waste sector (CRF 5), and non-biogenic GHG emissions from MSW incineration (CRF 1A1ai)



3.2.9 Waste

GHG emissions from waste (excluding waste incineration with energy recovery) accounted for 1.39% of total national emissions in 2015, compared to 3.01% in 1990. This decrease is mainly due to CH_4 emissions from solid waste disposal on land, which represents 58.7% of total emissions from the waste sector in 2015. Emissions in solid waste disposal on land have dropped by 69% in 2015 since 1990. Biogas recovery in landfills by flaring or for energy purposes – depending on the richness of the landfill gas – has been developed on a wide scale since 1990 and is the main driver of the trend in this sector, together with a significant decrease in the amounts of waste disposed due to the shift from waste disposal to re-use, recycling, composting or incineration of waste.

The remaining 41.3% of GHG emissions originates from three sources: waste incineration (18.4% in 2015), wastewater treatment (18.9%) and composting (4.0%). Emissions from waste incineration (sector 5C) include mainly CO_2 emissions from flaring activities (and post-combustion activities) in the chemical industry, while emissions from municipal waste incineration without energy recuperation decrease significantly. Emissions of municipal waste incineration are mainly allocated in the energy sector (1A1a), as almost all municipal waste incineration plants are also electricity producers (except for some plants in the early nineties). Incineration of hospital waste is also included following the IPCC Guidelines. The non-biogenic CO_2 emissions from the municipal solid waste incineration with energy recovery (sector 1A1a) are shown separately in Figure 3.13 to give a complete overview of the greenhouse gas emissions associated with waste (kton CO_2 eq).

3.3. National inventory system

No change has occurred since the 6th National Communication and 2nd Biennial report.

3.3.1. Overall responsibility for the Belgian national inventory

The agency designated as the "single national entity with overall responsibility for the national inventory" (national compiler) is the Belgian Interregional Environment Agency CELINE-IRCEL[7], established by the Cooperation agreement of 18 May 1994 (modified by the decision of 21 May 1995) on atmospheric emissions monitoring and data structuring. It includes members of the three regions.

3.3.2. Legal arrangements and regional agencies

General description

In the Belgian federal context, major responsibilities related to environment lie with the regions. Compiling greenhouse gas emissions inventories is one of these responsibilities. Detailed information regarding legal arrangements and inventory preparation can be found in Chapters 1.2, 1.3 and Chapter 12 of the National Inventory Report.

Each region implements the necessary means to establish their own emission inventory in accordance with the IPCC guidelines. The emission inventories of the three regions are subsequently combined to compile the national greenhouse gas emission inventory. Since 1980, the three regions have been developing different methodologies (depending on various external factors) for compiling their atmospheric emission inventories. Important efforts were made to tune these different methodologies, especially for the most important (key) sectors. At the same time, harmonization efforts have been done, in order to ensure the consistency of the data and to establis the national inventory.

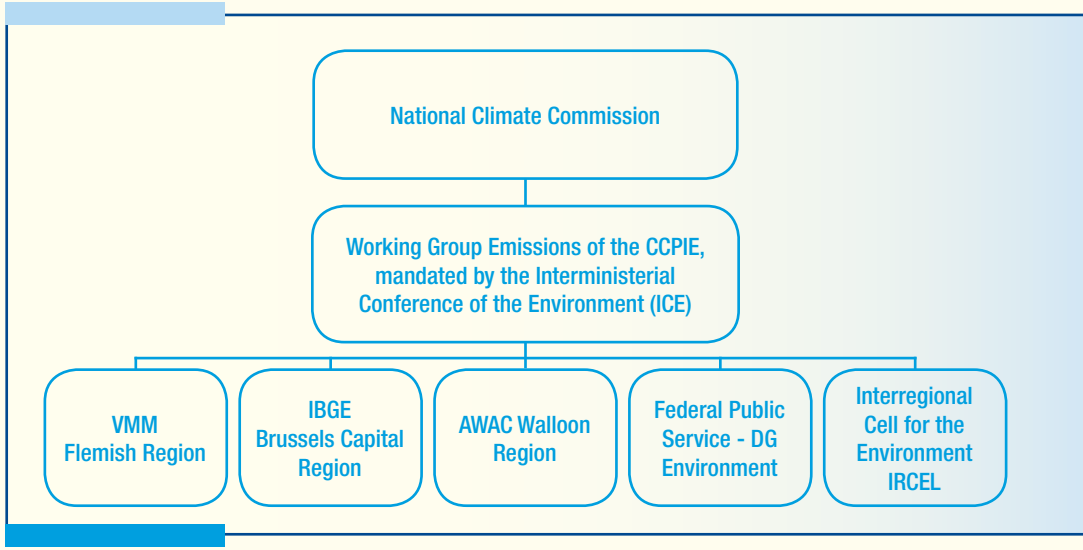
Coordination of the national inventory and harmonization of the methodologies are permanent duties of the Working Group on «Emissions» of the *Coordination Committee for International Environmental Policy* (CCIEP), where the different actors decide how the regional data will be aggregated to a national total, taking into account the specific characteristics and interests of each region as well as the available means. This working group consists of representatives of the 3 regions and of the federal public services.

The *Interregional Environment Agency* (CELINE - IRCEL) is responsible for integrating the emission data from the inventories of the three regions and for compiling the national inventory. The National inventory report is than formally submitted for approval to the National Climate Commission, established by the Cooperation agreement of 14 November 2002, before its submission to the secretariat of the United Nations Framework Convention on Climate Change and to the European Commission, under the European Parliament and Council Regulation (EU) No 525/2013 concerning a Mechanism for Monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC.

Overview of institutional, legal and procedural arrangements for compiling GHG inventory and supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

The Inter-ministerial Conference for the Environment took a series of decisions that clarify the role and responsibilities of different entities, as regards the preparation of the national GHG inventory. These decisions are detailed in the NIS.

Entities responsible for the performance of the main functions of the Belgian Inventory System, as well as main institutional bodies in relation with the decision process as regards this system, are presented hereafter.



[7] CELINE/IRCEL – Rue Gaucheret 92-94, 1030 Brussels +32 (0)2 227 57 02

As decided by the legal arrangements, the 3 regions are responsible for delivering their greenhouse gas inventories, which are later compiled to produce the Belgian GHG inventory. The main regional institutions involved are:

- **The Department Air, Environment and Communication of the Flemish Environment Agency (VMM)** in the Flemish Region;
- **The Walloon Agency for Air and Climate (AWAC)** in the Walloon Region;
- **Brussels Environment** in the Brussels Capital Region.

Each region has its own legal and institutional arrangements, which are detailed in the NIS.

The Directorate General Environment of the Federal Public Service for Health, Food Chain Safety and the Environment (FPS - DG Environment) is involved in its capacity of UNFCCC National Focal Point of Belgium and registry administrator.

The Directorate General Energy of the Federal Public Service Economy, SMEs, Self-employed and Energy (FPS - DG Energy) is responsible for the top-down estimation of energy-related CO_2 emissions using the IPCC 'reference approach'.

The Working group on Emissions of the Coordination Committee for International Environmental Policy (CCIEP) (referred to below as 'CCIEP-WG Emissions') plays a central role in the coordination of the national GHG inventory.

The Belgian Interregional Environment Agency (IRCEL-CELINE) is the single national entity with overall responsibility for the preparation of the Belgian GHG inventory. IRCEL-CELINE operates as national compiler of greenhouse gas emissions in Belgium.

The National Climate Commission is in charge of the approval of the inventory reports.

3.3.3. Process for the development of emission estimates

A general and detailed description of the methodologies can be found in the National Inventory Report submitted each year to the UNFCCC.

By intensively following regional, national and international workshops on estimating GHG emissions and sinks, the organizations responsible for establishing the emission inventory in Belgium keep in touch with all possible developments on that subject and try to optimise the emission inventory as efficiently as possible.

3.3.4. Key source identification

Key source categories are identified according to the Tier 1 methodology described in the IPCC 2006 Guidelines, Vol 1, chap 4. Both a level assessment (contribution of each source category to the total national estimate) and a trend assessment (contribution of each source category's trend to the total trend) are conducted during this submission. A level assessment is performed for the years 1990, 2014 and 2015 and trend analysis is carried out for the years 1990-2014 and 1990-2015.

The key source analysis is realised on the basis of Table 4.1, page 4.8 of Volume 1 of the IPCC GPG 2006 guidelines. Each greenhouse gas emission from one single source category is considered separately. The key source analysis is performed by using CO_2-equivalent emissions calculated by means of the global warming potentials (GWPs) specified in the UNFCCC reporting guidelines on annual inventories.

The level assessment with LULUCF for 2015 results in the identification of 48 key sources, covering 95 %[8] of the total national aggregated emissions. These 48 key sources are to a large extent the same as those identified for the year 2014.

59 categories are identified as key source from the trend assessment with LULUCF 1990-2015 as those that contribute to 95 % to the trend of the inventory. There is a slight difference in amount between the trend assessments with LULUCF for the years 1990-2014 (58 key sources) and 1990-2015 and the identified key sources overlap to a large extent.

[8] This threshold (95 %) is recommended in the 2006 *IPCC Guidelines forNational Greenhouse Gas Inventories*, for both the Level Assessment and the Trend Assessment ; it was determined to be the level at which 90 % of the uncertainty in a 'typical' inventory would be covered by key source categories, for the Tier 1 method.

3.3.5. Recalculation

Recalculations of the GHG emissions in Belgium in accordance with the IPCC Good Practice Guidance and relevant decisions of the COP and/or COP/MOP, are carried out in the regional and national emission inventory. All recalculations of previous submitted estimates of GHG emissions by sources and removals by sinks are described yearly in the National Inventory Report (sections 3 to 10).

Many recalculations have been conducted as a result of the 2016 Comprehensive review of national greenhouse gas inventory data pursuant to Article 19(1) of Regulation (EU) No 525/2013 (ESD-review). Details are given in Chapter 9 of the NIR 2017.

3.3.6. Quality assurance and quality control plan

Belgium did submit an updated QA/QC plan of the Belgian national system to estimate anthropogenic greenhouse gas emissions by sources and removals by sinks under Article 5, paragraph 1, of the Kyoto Protocol in April 2017.

Belgium is a federal state in which the competences are spread between four entities (see Chapter 2.1).

The activities of these four bodies, as regards the preparation of the national GHG inventory based on the three regional emission inventories and the implementation and development of the QA/QC plan,

are coordinated by the "Working group on Emissions of the Coordination Committee for International Environmental Policy (CCIEP)" (referred to below as "CCIEP-WG Emissions").

This group plays a central role in the coordination of the national GHG inventory. It is a permanent platform for the exchange of information between the National Climate Commission, the Energy Observatory, the Belgian UNFCCC National Focal Point, the Interregional Environment Agency (IRCEL/CELINE) and the three regions. All methodological aspects of the GHG inventory as well as the implementation and improvement of the national system, including the QA/QC plan, are coordinated via this CCIEP-WG Emissions. This working group meets on a regular basis and is responsible for coordinating all emission inventory tasks in Belgium. This group proposes a national inventory to the National Climate Commission (e.g. the Belgian political level) that submits the inventory and related documents to the UNFCCC-secretariat.

More information on the various actors can be found in the Belgian National Inventory System that was updated on the occasion of the 2017 submission to the UNFCCC-secretariat.

3.3.7. Procedures for the official approval of the inventory

After the national inventory is compiled, under the CRF format, the Belgian CRF-submission is first approved by the CCIEP-WG Emissions. Then it is transmitted to the National Climate Commission. All the mandatory reports in the framework of the UNFCCC, the Kyoto protocol and the European regulation 525/2013/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol are subject to approval by the National Climate Commission. The final drafts of these mandatory reports are communicated for approval to the National Climate Commission two weeks before the due date for submissions. These draft reports may be amended at the request of the National Climate Commission. At least 1 week before the due date for the submission, the National Climate Commission gives its approval on the documents, which are then submitted to the UNFCCC Secretariat through the UNFCCC National Focal Point or to the EU Commission.

Timeline for the approval and submission of inventory data (year 20XX as last year available) and other information related to GHG inventories:

- 01/01/20XX+2: submission of inventory data and supplementary information to the NCC for approval (submission to the European Commission: 15/01)
- 01/03/20XX+2: submission of the final versions of the national inventory data, the NIR and supplementary information to the National Climate Commission (submission to the European Commission: 15/03);
- 31/03/20XX+2: submission of the final versions of the national inventory data, the NIR and supplementary information to the National Climate Commission (submission to the UNFCCC: 15/04).

3.4. National registry

3.4.1 The Belgian registry

Directive 2009/29/EC adopted in 2009, provides for the centralization of the EU ETS operations into a single European Union registry operated by the European Commission as well as for the inclusion of the aviation sector. At the same time, and with a view to increasing efficiency in the operations of their respective national registries, the EU Member States who are also Parties to the Kyoto Protocol (26) plus Iceland, Liechtenstein and Norway decided to operate their registries in a consolidated manner in accordance with all relevant decisions applicable to the establishment of Party registries - in particular Decision 13/CMP.1 and Decision 24/CP.8.

The consolidated platform which implements the national registries in a consolidated manner (including the registry of the EU) is called the Union registry and was developed together with the new EU registry on the basis the following modalities:

- Each Party retains its organization designated as its registry administrator to maintain the national registry of that Party and remains responsible for all the obligations of Parties that are to be fulfilled through registries;
- Each Kyoto unit issued by the Parties in such a consolidated system is issued by one of the constituent Parties and continues to carry the Party of origin identifier in its unique serial number;
- Each Party retains its own set of national accounts as required by paragraph 21 of the Annex to Decision 15/CMP.1. Each account within a national registry keeps a unique account number comprising the identifier of the Party and a unique number within the Party where the account is maintained;
- Kyoto transactions continue to be forwarded to and checked by the UNFCCC Independent Transaction Log (ITL), which remains responsible for verifying the accuracy and validity of those transactions;

- The transaction log and registries continue to reconcile their data with each other in order to ensure data consistency and to facilitate the automated checks of the ITL;
- The requirements of paragraphs 44 to 48 of the Annex to Decision 13/CMP.1 on making non-confidential information accessible to the public is fulfilled by each Party through a publically available web page hosted by the Union registry;
- All registries reside on a consolidated IT platform sharing the same infrastructure technologies. The chosen architecture implements modalities to ensure that the consolidated national registries are uniquely identifiable, protected and distinguishable from each other, notably:
  a) With regards to the data exchange, each national registry connects to the ITL directly and establishes a secure communication link through a consolidated communication channel (VPN tunnel);
  b) The ITL remains responsible for authenticating the national registries and takes the full and final record of all transactions involving Kyoto units and other administrative processes in such a way that those actions cannot be disputed or repudiated;
  c) With regards to the data storage, the consolidated platform continues to guarantee that data is kept confidential and protected against unauthorized manipulation;
  d) The data storage architecture also ensures that the data pertaining to a national registry are distinguishable and uniquely identifiable from the data pertaining to other consolidated national registries;
  e) In addition, each consolidated national registry keeps a distinct user access entry point (URL) and a distinct set of authorisation and configuration rules.

Following the successful implementation of the Union registry, the 28 national registries concerned were re-certified in June 2012 and switched over to their new national registry on June 20th, 2012. Croatia was migrated and consolidated as of March 1st, 2013. During the go-live process, all relevant transaction and holdings data were migrated to the Union registry platform and the individual connections to and from the ITL were re-established for each Party.

The following changes to the national registry have occurred since the last National Communication report:

Reporting Item	Description
15/CMP.1 Annex II.E paragraph 32.(a) Change of name or contact	None
15/CMP.1 Annex II.E paragraph 32.(b) Change regarding cooperation arrangement	No change of cooperation arrangement occurred during the reported period.
15/CMP.1 Annex II.E paragraph 32.(c) Change to database structure or the capacity of national registry	In 2016, new tables were added to the database for the implementation of the CP2 functionality. Versions of the Union registry released after 6.1.6 (the production version at the time of the last NC submission) introduced other minor changes in the structure of the database. These changes were limited and only affected EU ETS functionality. No change was required to the database and application backup plan or to the disaster recovery plan. No change to the capacity of the national registry occurred during the reported period.
15/CMP.1 Annex II.E paragraph 32.(d) Change regarding conformance to technical standards	Each release of the registry is subject to both regression testing and tests related to new functionality. These tests also include thorough testing against the DES and were successfully carried out prior to each release of a new version in Production. Annex H testing is carried out every year. No other change in the registry's conformance to the technical standards occurred for the reported period.

Reporting Item	Description
15/CMP.1 Annex II.E paragraph 32.(e) Change to discrepancies procedures	No change of discrepancies procedures occurred during the reported period.
15/CMP.1 Annex II.E paragraph 32.(f) Change regarding security	The mandatory use of hardware tokens for authentication and signature was introduced for registry administrators.
15/CMP.1 Annex II.E paragraph 32.(g) Change to list of publicly available information	Publicly available information is provided via the Union registry homepage for each registry e.g. https://ets-registry.webgate.ec.europa.eu/euregistry/BE/index.xhtml
15/CMP.1 Annex II.E paragraph 32.(h) Change of Internet address	No change of the registry internet address occurred during the reporting period.
15/CMP.1 Annex II.E paragraph 32.(i) Change regarding data integrity measures	No change of data integrity measures occurred during the reporting period.
15/CMP.1 Annex II.E paragraph 32.(j) Change regarding test results	Both regression testing and tests on the new functionality are carried out prior to release of the new versions in Production. The site acceptance tests are carried out by quality assurance consultants on behalf of and assisted by the European Commission. Annex H testing is carried out on a yearly basis.

The website address of the Belgian registry is:

https://ets-registry.webgate.ec.europa.eu/euregistry/BE/index.xhtml

Several public reports regarding the registry (accounting/SEF reports, project information…) are made available on the registry's general public website: https://www.climateregistry.be/en/links-reports/links-reports.htm#KYOTO

3.4.2 The registry administrator

The Belgian Federal Public Service of Public Health, Food Chain Safety and Environment has been designated as registry administrator by Belgium to maintain its national registry:

Federal Public Service of Public Health, Food Chain Safety and Environment
DG Environment - Climate Change Section
The Registry Administrator
Eurostation Building, Victor Hortaplein 40 - bus 17, 1060 Brussels
tel: +32 (0)2 524 95 32
e-mail: helpdesk@climateregistry.be
website: http://www.climateregistry.be

Four persons have been designated as authorized representative of the registry administrator:

- Mark Looman
  tel: +32 2 524 95 32
  email: mark.looman@environment.belgium.be
- Pieter Baeten
  tel: +32 2 524 96 99
  email: pieter.baeten@environment.belgium.be
- Henri Kevers
  tel: +32 2 524 95 21
  email: henri.kevers@environment.belgium.be
- Peter Wittoeck
  tel: +32 2 524 95 28
  email: peter.wittoeck@environment.belgium.be

The registry administrator performs a wide range of tasks, the details of which are defined in the EU Emissions Trading Directive, the EU Registry Regulation, the Belgian Royal Decree on the registry and specific cooperation agreements between the Belgian Federal Government and the three Belgian regions in this regards [6]. ■

References

[1] Federal Public Service Economy, S.M.E.s, Self-employed and Energy - (Direction générale de l'Energie - Observatoire de l'énergie) - http://economie.fgov.be/

[2] Banque nationale de Belgique [National Bank of Belgium] (Comptes nationaux / régionaux) - and VITO (Vlaamse Instelling voor Technologisch Onderzoek) [Flemish Institute for Technological Research] - http://www.emis.vito.be/

[3] Federal Planning Bureau - http://www.plan.be/

[4] Federal Public Service Economy, S.M.E.s, Self-employed and Energy - Statistics Belgium

[5] SPF Mobilité et transport [FPS Mobility and Transport]

[6] https://www.climateregistry.be/en/registry/legal-framework.htm

4. Policies and measures

4.1. Policy-making process

4.1.1 Overall policy context

Belgium is a federal state where the decisional power is shared between a federal authority, three Regions (Wallonia, Flanders and the Brussels-Capital Region) and three communities (Flemish Community, French Community and the German-speaking Community) (cf. Chapter 2.1).

Primary responsibility regarding climate policy lies with the Federal State and the three Regions. The general context for the preparation of climate change policies and measures is determined by the plans established by the federal and regional authorities, setting out their respective policy objectives and strategies.

Cooperation bodies have been set up to coordinate and create synergies between the policies implemented by the various authorities, among which, the National Climate Commission is directly concerned by the matters covered here (cf. Chapter 2.1.3). This Commission, established by the Cooperation agreement of 14 November 2002, is primarily responsible for the establishement, evaluation and update of a National Climate Plan and for establihing the mandatory reports under the UNFCCC and KP and under EU legislation. The National Climate Commission reports annualy on its activities and on its evaluation of the policies and measures contained in the National Climate Plan to the Interministerial Conference for the Environment.

In this context, a National Climate Plan (NCP) for the period 2009-2012 was adopted in April 2009, built upon policies and measures elaborated by each of the 4 decisional entities. It remains in application until the first National Energy and climate Plan (NECP2030) is adopted for the period 2021-2030. The new NECP 2030 will have to be adopted at the latest by the end of 2019, in accordance with the European regulations (package “Clean energy for all Europeans”). The formal absence of a national plan for 2013-2020 is nevertheless partially offset by the existence of regional plans and the domestic cooperation agreement.

4.1.2 National targets

4.1.2.1 Belgium and the Kyoto Protocol

Belgium ratified the United Nations Framework Convention on Climate Change and the Kyoto Protocol respectively in 1996 and in 2002.

1st Kyoto commitment period: 2008-2012

Belgium’s target for the first commitment period of the Kyoto protocol was established under the joint commitment of

the European Union and its Member States to cut greenhouse gas emissions by 8% compared to base-year levels in the period 2008-2012. This joint commitment was fulfilled. Belgium's contribution to this commitment consisted in a reduction target of 7.5% of its greenhouse gas emissions over that period[1]. This commitment implied a reduction of greenhouse gas emissions from 145.729 Mt CO_2 eq in base-year level (BYE) to an annual average of 134.799 Mt for the period 2008-2012. Belgium overachieved its commitments for the first commitment period of the Kyoto Protocol from 2008 to 2012, reducing its emissions (expressed on an annual basis) by 14% compared to BYE (cf. Chapter 5.3.2).

2nd Kyoto commitment period: 2013-2020

For the second commitment period of the KP (2013-2020), EU countries (together with Iceland) have agreed to jointly meet a 20% reduction target compared to 1990 (in line with the EU's domestic target of 20% by 2020). The 20% emission reduction target by 2020 is unconditional and supported by legislation in place in the context of the EU Climate and Energy package 2020. This joint target has been shared between two sub-targets, for emissions in sectors covered by the EU Emission trading system (ETS), and for sectors outside the ETS. Reduction target for ETS was established for the EU as a whole, while national targets were set up for non-ETS sectors (see further details in section below).

[1] 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 thereunder.

4.1.2.2 Belgium targets under the European legislation

i. 2020 Climate and Energy package

As a Member State of the European Union, Belgium is committed to provide its contribution to the objectives of the 2020 Climate & Energy Package, by:

- covering 13% of its gross final energy demand with renewable energy sources by 2020[2]
- reducing greenhouse gas emissions of non ETS (ESD) sectors by 15% in 2020 (from 2005 level)[3]
- using energy more efficiently (for the transposition and implementation of the Energy Efficiency Directive[4], Belgium communicated in June 2013 an indicative energy efficiency target of 18% reduction of primary energy compared to the projected gross inland energy consumption – excluding non energy uses – for 2020).

National objectives for GHG emissions and renewable energy sources have been shared between the 4 authorities (Federal state and Regions), in the context of the 'burden sharing' agreement. The political agreement on the burden sharing for the period 2013-2020 was reached in December 2015.

[2] Renewable energy Directive 2009/28/EC
[3] Effort Sharing Decision EC/406/2009
[4] Energy Efficiency Directive 2012/27/EU

This agreement covers:

1. Greenhouse gas emissions reduction objectives, for sectors that are not covered by the EU ETS ("non-ETS" sectors)
2. Renewable energy objectives
3. Share of the auctioning revenues of ETS emissions allowances
4. Contribution to international climate financing

The agreement was enforced by a legally binding cooperation agreement between the regions and the federal state which contains not only the commitments of the political agreement, but alos identifies implementation modalities and responsibilities.

ii. 2030 Climate and Energy framework

In 2014, the European Council agreed on the 2030 climate and energy policy framework for the EU and endorsed new EU targets on greenhouse gas emissions, renewable energy and energy efficiency for 2030:

- at least 40% reduction (compared to 1990) of greenhouse gas emissions. This target is divided between:
  - a target of -43% (compared to 2005) for the ETS sector
  - a target of -30% (compared to 2005) for the non ETS sector. This objective must be translated into binding national targets for the Member States.
- minimum 27% renewable energy share by 2030.
- reducing Europe's energy use by at least 27% by 2030.

On 20 July 2016, the European Commission presented a legislative proposal, the 'Effort Sharing Regulation', which sets out binding annual GHG emission targets for Member States for the period 2021-2030 (EC, 2016a). The proposal is the follow-up to the ESD. Under this proposal, national objective for Belgium would be -35% in the non ETS sector.

Once national targets decided, they will be shared between the 4 authorities (Federal state and Regions) in a new 'burden sharing' agreement (2021-2030).

i.i.i ETS

An essential element of Belgium's climate policy relies upon the European Emissions Trading System (Directives 2003/87/EC and 2009/29/EC). It constitutes a key instrument to help energy-intensive sectors to improve their energy efficiency while optimising costs.

During the period covered by the first commitment period under the Kyoto Protocol, Belgium established and managed its National Allocation Plans (2005-2007 and 2008-2012). However, as a single EU-wide cap on emissions now applies instead of the previous system of national caps, Belgium only manages and monitors

the implementation of the 3rd phase (2013-2020) on its territory.

4.1.2.3 Sustainable development

Different strategies in relation to sustainable development have been adopted by the respective levels of power:

- Federal level: the federal sustainable development plans and the Long-term Vision for Sustainable Development adopted in 2013 which identifies 55 long term objectives (i.a. objective 31 'Belgian greenhouse gas emissions will be reduced domestically by at least 80 % to 95 % in 2050 compared to 1990' and objective 32 'Belgium will be adapted to the direct and indirect impacts of the climate change');
- Flanders: Vision 2050 - A long-term strategy for Flanders, which constitutes the third Flemish strategy for sustainable development;
- Wallonia: the second Walloon strategy for sustainable development;
- Brussels-Capital Region: the regional sustainable development plan;
- German-speaking Community: the second regional development plan.

For more information we refer to Belgium's first evaluation report on the Sustainable Development Goals (July 2017).

4.1.3 System for monitoring and evaluation of policies and measures

The National system for policies and measures and projections represents the institutional, legal and procedural arrangements established for reporting on policies and measures and projections of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol, in accordance with the EU Monitoring Mechanism Regulation (525/2013). It seeks to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of the information on policies and measures and projections reported by Belgium pursuant to Article 13 and Article 14 of the Monitoring Mechanism Regulation (MMR). A full and detailed description of the National system is given in the report of March 2017 "Reporting on policies and measures– BELGIUM under article 13 of Regulation (EU) N° 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision N° 280/2004/EC". This also includes in annex the description of the "National system for policies and measures and projections and the quality assurance and control (qa/qc) programme as required under regulation (eu) no 525/2013".

In accordance with the cooperation agreement of 14 November 2002, the Regions and the Federal state are committed to yearly evaluate the progress and implementation of their policies and measures, in a harmonized way, including by estimating their impact in terms of GHG emission reductions.

Methodologies vary depending on the domain targeted and the availability of data, but should at best be harmonized among the different entities, in order to ensure comparability and the ability to identify the most efficient measures.

To this end, the National Climate Commission has created an *ad-hoc* working group, gathering representatives of each entity and various administrations concerned by elements of the NCP. In particular, the group integrates representatives of the energy administrations in charge of monitoring and reporting the energy efficiency action plan established in the framework of Directives 2006/32/EC and 2012/27/EU relative to energy efficiency and services, to ensure a necessary harmonisation of methodologies, hypotheses and parameters between climate and energy policies quantifications.

Federal

Successive studies have been commissioned in order to realise a quantitative evaluation of the impact of federal measures in terms of greenhouse gas emission reductions. These studies evaluated the effect of the federal measures on expected emission reductions up to 2020 and estimated the remaining impact up to 2035 assuming the measure being withheld after 2020.[5] Socioeconomic impact of some federal PAM has also been evaluated. The most recent study ("Development of impact assessment methods for policies and measures carried out within the framework of the federal climate policy - Evaluation of emission reductions Report", ICEDD - Aether - TML – TNO) was finalised in June 2017.

A key methodological difficulty in such an evaluation is to disentangle the impact of a given federal measure from a regional one when both types of measures do target the same sector and the same action. The way federal and regional measures are linked to and complement each other is therefore a central issue. In any case, global effects of PAMs developed by different entities and targeting a given sector apply to the whole country, so the difficulty to calculate the shares of the different entities should not hamper their analysis in the context of this report.

[5] See the different reports on http://www.climat.be/evaluation-PAMs (FR) or http://www.klimaat.be/evaluatie-PAMs (NL), reports are in EN.

A new federal MRV law[6] was recently adopted (October 2016). It puts in place the framework for the reporting, monitoring and evaluation of federal policies and measures in the field of climate change and ozone layer protection. According to the law all entities and departments of the federal authority in possession of relevant data and information shall communicate them annually in order to guarantee the timeliness, transparency, accuracy, consistency, comparability and completeness of the information reported.

Regional

The three regions have developed thier own projection model for energy demand and atmospheric emissions from stationary sources (residential, tertiary, industry and heat and electricity sector).

The simulation model is a projection model for energy demand, greenhouse gas emissions and emissions of air pollutants (SO_2, NOx, PM and VOC) that covers most of the relevant emission sectors (energy sector, industry, waste, agriculture, residential and commercial buildings). This simulation model works as a "bottom-up" type model, i.e. explaining energy consumptions and emissions from activity variables expressed as far as possible in physical units, and the main determining factors of the evolution of energy demand and emissions. Every year the model is calibrated with the most recent regional energy balance, and the main data is updated (population, employment, climate, household size, among other information).

The model, which includes a database on the energy consumption, emission factors, activity data and reduction effects of climate & energy and air quality policy measures, can be 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 based on expected economic and demographic evolutions: With Existing Measures (WEM) Scenario;
- constructing emission reduction scenarios, based on the implementation of a combination of reduction measures With Additional Measures (WAM) Scenarios;
- assessing the impact of existing or draft legislations on energy consumption and emission levels.

[6] « Loi portant sur les modalités d'application du Règlement (UE) n° 517/2014 du Parlement européen et du Conseil du 16 avril 2014 relatif aux gaz à effet de serre fluorés et abrogeant le règlement (CE) n° 842/2006 et du Règlement (UE) n° 525/2013 du Parlement européen et du Conseil du 21 mai 2013 relatif à un mécanisme pour la surveillance et la déclaration des émissions de gaz à effet de serre et pour la déclaration, au niveau national et au niveau de l'Union, d'autres informations ayant trait au changement climatique et abrogeant la décision n° 280/2004/CE ».

4.2 Domestic and regional programs; legislative arrangements, enforcement and administrative procedure

4.2.1 Description of domestic legislative arrangements to meet the Kyoto Protocol commitments

According to the Kyoto Protocol reporting guidelines (paragraph 37), Belgium must draw up a report describing all the domestic and regional legislative arrangements and all the enforcement and administrative procedures to be put in place, how they are implemented, and which procedures apply for addressing cases of non-compliance under the Belgian legal framework.

4.2.1.1 Cooperation Agreement of 14 November 2002

The legal basis for the obligation to evaluate the federal policies and measures (PAMs) is the Cooperation Agreement of 14 November 2002 between the Federal State, the Flemish Region, the Walloon Region and the Brussels Capital Region, which provides that a National Climate Plan must be drawn up, executed, evaluated and reported to the UNFCCC under the Kyoto protocol.

This Agreement also originates from the obligation to apply European Decision 280/2004/EC (now replaced by Regulation (EU) No 525/2013 or MMR) establishing the mechanism for monitoring and reporting greenhouse gas emissions in the European Community and for implementing the Kyoto Protocol.

And precisely, as requested by art. 12 of the MMR, Belgium has set up a national system for policies and measures and projections.

4.2.1.2. Cooperation agreement 'Burden Sharing'

The cooperation agreement on the Burden Sharing (2013-2020) will provide the legal basis for the decisions to be taken to honor the commitments entered into by Belgium under the European Energy & Climate Package.

4.2.1.3. Mechanism for increasing awareness of climate responsibility among the Regions for the building sector

Under the Law of 6 January 2014, this mechanism consists of establishing a multiannual trajectory for the reduction of greenhouse gas emissions in the residential and tertiary building sectors (excluding industrial buildings), for each Region. A financial bonus is awarded to a region when it exceeds its assigned objective. The bonus is calculated on the basis of the reference trajectory, and is to be invested in emission reduction policies. If a region fails to meet its assigned objective, a financial penalty is to be inflicted. The penalty will be calculated on the basis of the difference between the reference trajectory and the actual emissions, to be invested in emission reduction policies by the Federal State. This mechanism will be fuelled by the revenues from the auctioning of emission quotas assigned to Belgium that are yet to be distributed between the Regions and the Federal State through the domestic burden-sharing arrangement. The amounts are calculated by multiplying the distance to target in tonnes of CO_2 eq. with the emission quotas average price auctioned during the same year. In order to ensure that a sufficient proportion of the auctioning revenues is preserved, a bonus ceiling is set at a level equal to the Federal State's share of auctioning revenues, while the penalties ceiling is set at 50% of the regional share of the auctioning revenues. This mechanism has not yet been put in place.

4.2.1.4 Substitition right for international obligations under the UNFCCC and its Protocols

The 'substitution right' is a mechanism introduced into Belgium law, with the aim of ensuring Belgium's compliance with its international obligations. Under Belgian domestic law, competences that are attributed exclusively to an entity mean that it is competent for compliance with the obligations in the same field of competence at national, European and international level, to the exclusion of other entities. However, international public law does not allow federal states to withdraw from their international obligations on the basis of domestic law arrangements, as specified in Article 27 of the Vienna Convention on the Federal State vouches for international law violations on the part of federal entities. The substitution right was introduced in order to remedy the contradiction between Belgium domestic law and international and European law. This right is now extended more specifically to Belgium's international obligations under the UNFCCC and its Protocols (Article 16(4) of the Special Institutional Reform Law of 8 August 1980). In principle, this right enables the Federal State, under strict conditions, to substitute its action for the non-action of a federal entity when it is the subject of a non-compliance assessment reported by a relevant body under the UNFCCC or its Protocols. This mechanism also applies to European law obligations aiming at implementing the UNFCCC and its Protocols.

4.2.1.5. Plans

National Climate Plan

The National Climate Plan 2009-2012 (extended until the new NECP2030 is adopted) was approved by the National Climate Commission. For more information on the National Climate Plan, we refer to Chapter 4.3.1 of the 6th National Communciation.

NCEP 2021-2030

At the end of 2016, the European Commission published a set of legislative proposals under the package "Clean energy for all Europeans". These proposals are currently being analyzed and are the subject of negotiations between the Member States and the Commission. Nevertheless, the European objective of reducing greenhouse gas emissions is -40% in 2030 compared to 1990. This corresponds to the prerequisites of the European commitment within the framework of the Paris Agreement. This European objective is the subject of a proposal of burden sharing between members states. During the year 2017, the work of the Belgian authorities (administrative and political) is intense and focuses on the implementation of new PAMs to achieve the ambitious objectives of 2030. This should be translated into the adoption of the NECP2030 by the end of 2019.

Federal

In accordance with the Cooperation Agreement on the national burden-sharing 2013-2020, the federal government is committed to pursue existing policies and measures allowing a total emission reduction of 15 250 kt CO_2 eq for 2013-2020 and to implement new policies and measures resulting in an additional reduction of at least 7 000 kt CO_2 eq for the period 2016-2020. A set of new federal PAMs was recently identified, which includes following PAMs: positive mobility allocations, incentives for electric bicycles, energy saving in railways as well as implementation of new EU legislative instruments in the field of product policy and fluorinated gases.

Flemish Region

In June 2013, the Flemish Government formally adopted its "Flemish Climate Policy Plan 2013-2020", or "Vlaams Klimaatbeleidsplan/VKP 2013-2020". The plan consists of an overall framework and two separate but closely related sections:

- The Flemish Mitigation Plan (VMP): the purpose of the VMP is to reduce emissions of greenhouse gases in Flanders between 2013 and 2020 as a means of combatting climate change. A basis will also be laid for the further emission reductions required towards 2050.
- The Flemish Adaptation Plan (VAP): the purpose of the VAP is to apprehend the Flemish vulnerability to climate change and subsequently improve its ability to defend against its effects.

An English summary of the VKP 2013-2020 is available.

The VMP is a strategic policy plan with measures for the non-ETS sectors in the Flemish Region from all relevant Flemish policy fields, and is linked to the Flemish government's broader policy. The plan contains actions from all the relevant areas of competence. It provides to Flanders the strategic support of the climate policy towards its contribution to the European and international commitments for the period 2013-2020.

To allow efficient follow up by the Flemish Government, the VMP provides for yearly progress reports that give an account of the state of affairs of the Flemish climate policy on mitigation. These reports allow the Flemish Government to respond timely when adjustments or new measures become necessary.

Walloon Region

In Wallonia, air protection and climate change policies are the object of a Walloon Air-Climate Plan notably aiming (for climate related matters) at respecting Wallonia's obligations in the framework for the Kyoto Protocol. Measures are implemented and monitored by the respective administrations in charge of those plans. The Walloon Agency for Air and Climate is in charge of the coordination, covering all aspects of those plans in relation with air protection and climate change. Regional Ministers are regularly informed of implementations and progress through an informal forum called the CLimate – Energy – Air group (CLEA).

In early 2014, the Parliament of the Walloon Region adopted the "Walloon Climate Decree" . It provides an overall framework for the Walloon climate policy for the next few decades. The decree fixes reduction objectives for total GHG emissions (i.e. ETS + non-ETS), namely -30% between 1990 and 2020, -80% to -95% between 1990 and 2050. It establishes a procedure to define emission budgets for successive periods of 5 years, thus progressively outlining a trajectory to reach the objectives. As the above objectives are not binding, the decree provides only guiding values. The successive 5 years Climate-Energy Action Plans will foster the efforts to reach these targets.

This decree will be instrumented through the new the Air-Climate Plan to 2020.

The text of the forthcoming Air, Climate and Energy Plan was presented to the Government and submitted to a public inquiry during the summer of 2014. It was adopted on April, 21st, 2016.

Brussels Capital Region

In 2009, Brussels committed itself to reducing its CO_2 emissions by 30% by 2025 compared with 1990. This pledge has been confirmed through the Convenant of Mayors in 2010 and more specifically in the Air-Climate-Energy Plan.

To meet all the challenges related to energy consumption, renewable energy, climate change and air quality, the Brussels-Capital Region has developed an integrated approach which has already been expressed in a regulatory document (Brussels Air, Climate and Energy control Code - COBRACE) and a planning document (Air, Climate, Energy Plan). The COBRACE has come into force in May 2013 and the plan has been adopted on June 2nd, 2016.

The COBRACE defines new requirements such as EPB standards, environmental performance standards for vehicles of public authorities, restriction on car parks at company buildings, and mandatory implementation of a local energy management plan for owners of large real estate portfolios; it also creates a climate fund to implement GHG emission-reducing measures, etc.

The Air-Climate-Energy Plan is the planning document linked to the Brussels integrated approach to air, climate and energy topics. It recalls the Brussels-Capital Region objectives for 2025 and is intended to set up the measures to be implemented in 2020 regarding energy (including renewable energy), climate change mitigation and adaptation, and air quality. The plan defines 144 actions into 64 measures which are declined into 10 axes: building, transportation, renewable energy, economy, global city planning, consumption, social dimension, climate change adaptation, air surveillance and international mechanisms.

4.2.2 Access to information

Public access to environmental information in Belgium, including legislative instruments, policies and measures developed under the Kyoto Protocol, is regulated at federal level and in the Regions by the legislation transposing European Directive 2003/4/EC on public access to environmental information (based on the first pillar of the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters). This has been reflected in various legislative and regulatory initiatives at both federal and regional levels.

The website of the National Climate Committee offers most of the relevant information on Belgian climate policy. (http://www.cnc-nkc.be/en).

4.2.3 Participation in the Kyoto mechanisms

The repartition of competence concerning approval of project activities is stipulated in a Cooperation Agreement between the Federal Government and the 3 Regions of the country concerning the implementation of certain provisions of the Kyoto Protocol (19 February 2007).

Designation of DNA/DFP

On 8 March 2007, Belgium notified the UNFCCC that its National Climate Commission (NCC) has been legally designated as national Focal Point (FP) and Designat-

ed National Authority (DNA) for JI and CDM project activity approval.

The approval procedures have been published on the website of the National Climate Commission.

In this role, the NCC is authorised to approve the project activities submitted to it. However, it must obligatorily respect the administrative and technical decisions by which the regional and federal authorities approve project activities in cases where this comes within their competence.

Distribution of authority for the approval of project activities

According to Article 1, Section 27, of the 'Flex Mex' Cooperation Agreement (and in accordance with the Marrakech Agreements), project approval constitutes written authorisation enabling one or more persons to participate in a project activity.

Article 5 of this Agreement specifies the cases in which the federal or regional authorities are authorised to grant approval. According to Article 7, the activities not covered by any of these categories are approved by the National Climate Commission.

Approval procedures

The Regions, the Federal Government and the National Climate Commission have adopted their procedure and approval criteria.

4.2.4 Information on Articles 3(3) and 3(4) of the Kyoto Protocol

Trends

The LULUCF sector as a whole (CRF category 4) was a net removal of 2 086.93 kt CO_2 eq in Belgium in 2015.

Regarding Art. 3.3, Afforestation, Reforestation and Deforestation, there is an overall balance between afforested and deforested areas (see National inventory Report, section 10.2.4), as confirmed by the stable forest area observed in forest inventories. However, due to accounting rules (instantaneous oxidation in the case of deforestation), this results in net emissions of 929.03 kt CO_2-eq. under Art 3.3.

Regarding Art 3.4, Belgium did not elected any activity, so Forest Management is the only relevant category. In 2015, Forest management resulted in a net sink of 3 371.68 kt CO_2-eq., compared to a current forest management refence level of 2 499 kt CO_2-eq. However, Belgium will only account at the end of the commitment period and technical correction of the FMRL may occur in the meantime.

Forest management

In Wallonia, the Forest Code (Decree of 15 July 2008) has introduced a certain number of constraints in favour of forest conservation and the maintenance of ligneous materials and carbon, including: abolition of inheritance duties on the stumpage value, which encourages more ecological forestry choices, restriction of clear-cutting; obligation to plant species suited to the site, creation of integral reserves; draining limitation. The designation of 1 500 km² of forests in Natura 2000 under special fixed rules of management also contributes to the various objectives of the Forest Code in Wallonia. Many areas are also certified under PEFC management standards.

In the Brussels Capital Region, the Forêt de Soignes/Zoniënwoud is protected (no deforestation allowed) and FSC certified. Its management aims to ensure ecological stability and a long-term balance in the distribution of forest age, taking into account biodiversity, ecological and social aspects.

The Flemish Region has an active forest expansion policy. The Flemish authorities have drawn up a strict regulation for optimum conservation and protection of the Flemish forest (Forest Decree of 13 June 1990 and Decree of 18 May 1999 concerning the organization of spatial planning and Decision of the Flemish Government on 16 February 2001 to clarify the rules concerning compensation and deforestation and exemption from the ban on deforestation). As a general rule, deforestation is prohibited. In addition, the Flemish authorities have created instruments to ensure the biodiversity and sustainable use of natural resources.

Additionnal information on forest management can be found in section 10.5.3 of the National Inventory Report.

4.2.5 International transport

International aviation

On 13 January 2009 Directive 2008/101/EC to include aviation in the European Union Emissions Trading Scheme (ETS) was published in the Official Journal of the European Union.

The Directive introduces an emission trading system for airlines. It requires the surrender of emission allowances for all CO_2 emitted during the calendar year (starting from 2012) by flights covered by the Directive. The emissions must be determined using a monitoring system, which is developed in accordance with the monitoring and reporting guidelines (MRG). Emissions must be reported after each calendar year (before April 1st of the following year) and the number of emission allowances corresponding to the reported emitted quantity of CO_2 must be surrendered before May 1st.

Due to progress made under the International Civil Aviation Organisation (ICAO) in developing a Global Market-based Measure, the EU decided to limit the scope of the EU ETS to flights within the EEA for the period 2013-2016.

During its General Assembly in October 2016, the ICAO agreed on a resolution that establishes the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which aims to stabilize emissions from international aviation at 2020 levels by requiring airlines to offset any growth in emissions above the 2020 level through the purchase of eligible emission units.

The abovementioned ICAO resolution foresees three phases in the design of the CORSIA: during the Pilot phase (2021-2023) and the first phase (2024-2026), participation of states is on a voluntary basis. All EU member states, including Belgium, have indicated they will participate in the scheme from the start (2021). During the second phase (2027-2035), participation is mandatory for all states that reach a certain level of aviation activity (expressed in Revenue Ton Kilometer), except for Least Developed Countries (LDCs), Small Island Developing States (SIDs) and Landlocked Developing Countries (LLDCs), which are exempted, but are encouraged to participate on a voluntary basis.

As a consequence of the adoption of the CORSIA, the European Commission published a legislative proposal to continue the current approach (i.e. a scope whereby the EU ETS only applies to flights within the EEA) from 2017 on, which could be reviewed after the publication of the implementation rules of the CORSIA. Consultations on this proposal are currently ongoing.

International shipping

In 2013, the European Commission put forward a legislative proposal for setting up a Monitoring, Reporting and Verification (MRV) system. This proposal eventually resulted in the adoption of the MRV for shipping regulation in 2015, which enters into force as of January 1st 2018 and introduces MRV obligations for ships over 5000 gross tons that call at ports in the European Economic Area.

In the mean time, a first internationally agreed binding measure entered into force to address emissions from international shipping: as of January 1st 2013, all ships over 400 gross tons are required to develop a Ship Energy Efficiency Plan (SEEMP) and new ships have to comply with standards set out in the Energy Efficiency Design Index (EEDI).

In 2016, the IMO adopted a Data Collection System similar to the European MRV. It is more inclusive but less ambitious for certain aspects.

Furthermore, in October 2016, an agreement was found on the development of a Roadmap for a comprehensive IMO strategy on reduction of GHG emissions from ships. An initial strategy must be adopted in 2018, and a revised strategy will be adopted in 2023. These strategies should, inter alia, include short-, mid-, and long-term further measure. Work on these strategies is currently ongoing.

4.3 Policies and measures and their effects

4.3.1 Update on policies and measures

4.3.1.1 PAMs from the National Climate Plan

Measures from the National Climate Plan (2009-2012) have been implemented and continue to deliver emissions reductions. A few measures have expired either because the source of emissions does not occur anymore or because the policy applied did not deliver the expected effects[7].

In 2011, an important package of tax measures was abandoned in view of the upcoming transfer of tax decisional powers from the federal level towards the Regions that occurs with the 6th State Reform. Consequently, a major support to RUE investments (40% tax deductibility) in the residential sector disappeared. Depending on their climate policy priorities, Regional authorities could however consider upgrading support to RUE investments. For instance, Wallonia announced recently its decision to merge and rationalize financial supports for the improvement of energy efficiency of dwellings and for the renovation of housing.

[7] For example, subsidies to the purchase of low energy consuming domestic appliances were abandoned in Wallonia, when it was observed for instance that people used the opportunity of the subsidy to purchase a second refrigerator, instead of replacing the existing one.

4.3.1.2 Towards 2020

The set of policies and measures to achieve the 2020 target are reflected in the federal and regional plans described in Chapter 4.2.1.5. These PAMs have already been described in the NC.

4.3.1.3. Recent developments of PAMs (up to 2020)

Federal level

In January 2017, the Federal Minister in charge of Energy and Environmental matters launched a national debate on carbon pricing in the non-ETS sector. The debate aims at exploring the options for implementing a carbon price in the sectors that are not part of the EU emissions trading system. The process, which involves all stakeholders, runs over the year 2017.

Furthermore, three major developments of the "Low carbon Belgium by 2050" project were undertaken since 2015:

- The analysis of the macroeconomic impact of the low carbon scenarios for Belgium ;
- The development of an educative webtool for the analysis of low carbon scenarios towards 2050, accompanied by an educative package targeting 15-

18 year students and involving "climate coaches" ;
- The analysis of the low carbon finance flows in Belgium.

Flemish Region

The Flemish Mitigation Plan 2013-2020 (VMP) recognized the need to develop a coherent long term strategy. The aim of the VMP is to achieve maximum integration of the long-term climate targets in the Flemish sector policy plans. An outlook to 2050 for each sector containing an initial evaluation of the European Commission's emission reduction paths for 2050 has been integrated in the VMP. A number of paths and strategic choices designed to enable this transition are subsequently discussed.

Since the approval of the plan, an exploratory study was completed concerning medium-long term (2030) and long-term (2050) energy and greenhouse gas scenarios for Flanders.

The 2015 Progress Report of the VMP contained a summary of this study, accompanied by more concrete policy recommendations that can be implemented in the short term with a view to achieving these long term scenarios.

Based upon the conclusions of the study, the 2015 progress report, the EU objectives towards 2030 and the aim to move towards a low-carbon economy in 2050, and the momentum created by the Paris Agreement, Flanders organised multisectoral climate summits in 2016 (including stakeholder consultations and involving every single minister) to work towards an integrated climate and energy plan for the period 2021-2030 and towards a long-term climate strategy (2050). The process in 2016 was concluded with the signing of the Flemish Climate and Energy Pact on the Flemish Climate and Energy Summit of December 1st, 2016. This pact consists of a declaration of commitment by the Flemish Government, an overview of new policy commitments by all the members of the Flemish Government, and a list of the commitments handed in by the stakeholders. The process will continue in 2017 and 2018.

Work to integrate the long-term climate targets in the Flemish sector policy plans is underway. For example: climate was integrated into the Renovation Pact for the residential sector and into the White Paper towards a Flemish Spatial Policy Plan.

Walloon Region

The Climate decree establishes a procedure to allocate emission budgets per periods of 5 years, describing trajectories towards emission reductions of 80 to 95% between 1990 and 2050. Since the previous NC, the Walloon Government adopted a new Air Climat Energy Plan 2016-2022 on April 21st, 2016.

Brussels Capital Region

The long term strategy is prepared through a full energy and emission simulation tool that was developed to support low-carbon scenarios for Brussels 2050. 6 scenarios were developed and analysed in order to reach 80 to 95% emission reduction in 2050.

In addition, 3 strategic plans were adopted in the Brussels Capital Region with a timeframe at 2025:

- The Air-climate energy plan
- The good food strategy
- The Regional Circular Economy Program

The Brussels-Capital Region is also working on the National Energy and Climate Plan for 2030.

4.3.2 Overview of the main PAMs

The National Climate Plan contains around 100 measures but only the main ones are reviewed here (see CTF Table 3). Research, training/education and development aid measures are covered in the other chapters of this 7th National Communication.

PAMS that have the most significant effects on reduction of greenhouse gas emissions:

- Power and renewable: green certificates, EC emission trading system (ETS)
- Transports: Promotion and investments in public transport and increase of the number of passengers transported via public service contracts; differentiated kilometer tax for heavy duty vehicles as of 2016, environmental characteristics of the vehicle fleet, support of alternative fuels (i.a. minimum biofuel blending levels in transport fuels), reform of vehicle registration tax (BIV)
- Buildings: energy performance of new buildings and full renovations, subsidies and/or tax reduction for RUE and RES investments in existing houses, audits, local Action Plans for Energy Management (PLAGE) (Brussels), projects to identify the potential for energy savings and priorities for action in hospitals, socials housing but also in some municipalities.
- Industry: Emission trading system for large and medium energy consuming enterprises, energy/CO_2 voluntary agreements
- Other: Catalytic reduction of N_2O emissions in the manufacturing of nitric acid (HNO_3), implementation of EU F-gas regulations (recently enhanced by adopting a new F-gas regulation in 2014)[8], ban on landfilling of organic

[8] Implementation measures relate to, among other things, the adjustment of national regulatory framework, the introduction of quotas (limiting the total amount of the most important F-gases that can be sold in the EU from 2015 onwards and phasing them down in steps to one-fifth of 2014 sales in 2030, this will be the main driver of the move towards more climate-friendly technologies); new and extended bans (banning the use of F-gases in many new types of equipment where less harmful alternatives are widely available, such as fridges in homes or supermarkets, air conditioning and foams, firefighting and aerosols); prevention of F-gases emissions from existing equipments by requiring checks, proper servicing and recovery of the gases at the end of the equipment's life (extended scope including trucks and trailers, maintenance

waste (CH_4), good manure management, small-scale anaerobic fermentation of manure (CH_4 and N_2O).

For more information, please refer directly to the National Climate Plan 2009-2012 (FR or NL and the report on policies and measures by Belgium under art. 13 of Regulation (EU) No 525/2013 dated 30 March 2017 for the European Commission.

4.3.3 Evaluation of the measures' impact on GHG emissions

Preamble

Each of the National Climate Plan measures aims to reduce our greenhouse gas emissions. They are government measures aimed at changing the behaviour of socio-economic actors. In the long term, their overall impact should be shown in the year-to-year evolution of emissions per sector as stated in the emissions inventories. However, although surveying the inventories will determine whether Belgium or its regions are close to meeting their reductions targets, this will not isolate the individual impact of each measure or separate the effect of the plan's measures from that of the "natural" evolution of the country's socio-economic activities for reasons other than having implemented the plan's measures.

of cars...); control of placing on the market and registration of sales of substances and equipment (database in development), record keeping, responsibility of producers; awareness raising and education measures.

Consequently, it is not possible to identify the individual impact of each of the plan's measures. This may be due to a number of circumstances:

- Some measures cut across all sectors and their impact is almost impossible to evaluate, such as awareness campaigns addressing the general public.
- Although the effectiveness of certain measures can be evaluated, this does not enable us to directly deduce their impact on emissions: a measure aimed at limiting parking supply in a city centre should eliminate a certain number of cars from the traffic, but it is impossible to evaluate the distances these cars had travelled beforehand. Drivers who no longer use their car, use another means of transport, but we don't know which one. It could be that they simply stopped using this type of transport.
- Implementing certain measures results in the adoption of traceable economic actions, such as purchasing equipment or applying for subsidies for investment in energy-saving equipment. In this instance, if sales or subsidy statistics are available, as well as an estimate of the energy savings and the resultant reduction in emissions, the impact of the measure can be estimated. This would nonetheless be approximate, given the uncertainties generally associated with estimating unit savings. Furthermore, it does not take into account all the reductions achieved by using such equipment, since some economic actors will have acquired it without applying for a subsidy.
- In some cases, a series of complementary measures are implemented that share the same objective. For example, to achieve a reduction in commuting journeys by car by promoting a modal shift towards public transport or alternative modes of transport such as walking or cycling, there needs to be an improvement in the provision of public transport (frequency, regularity, comfort, tariffs, zones served, connections etc.) and in access to and availability of parking around major public transport stations and hubs, while at the same time regulating or even limiting parking facilities in congested urban areas. Although it is possible to evaluate the impact of all these measures on the basis of the statistical trends in public transport use, the impact of each of these measures cannot be separated from the cluster as a whole, which shares the same objective.
- Finally, certain measures or certain clusters of measures actually constitute development policies. This is true of the green certificate (and/or CHP) systems aimed at developing electricity generation using renewable energy sources or high-efficiency cogeneration. It is also true of emissions reductions policies that originate from the industrial sector (ETS and voluntary agreements such as sectoral and benchmark agreements). In this instance, policy-makers have established monitoring indicators that enable an overall evaluation of the impact of their implementation.

Several factors influence our analysis, in particular:

- There are various uncertainties affecting the impact estimates, mainly regarding the baseline used to estimate the energy savings achieved as a result of the measure and the emissions consequently avoided. For example, it is estimated that insulating the roof of a residential home can reduce the fuel consumption used to heat the property by between 20 and 30%, but we only have a very rough estimate of an individual home's average consumption. By way of further example, we can observe and quantify the rise in railway use, but cannot guarantee that this increase can be attributed to the plan's measures.
- Duplications and double counting must be avoided: at one time, the acquisition of energy-saving equipment benefited from investment subsidies, but this was also eligible for tax relief, i.e. two mechanisms with the same objective. The two mechanisms complemented each other but the investment in reducing emissions was only made once. For example, when evaluating the impact of a policy of voluntary agreements in industry, care is taken not to add to this the impact of tax relief for energy-saving investments, given that a large number of tax relief applications come from companies engaged in such agreements.

Other phenomena can affect the impact of the measures, but their effect on estimating this impact cannot be taken into consideration here:

- The "windfall" effect: the measures implemented apply to all actors, even those who had already adopted the actions sought by the measure. For example, paying for the public transport commuting costs of public sector staff certainly encourages a modal shift from the car to these means of transport, but it also benefits the people already using this mode of transport before the measure was implemented. If a distinction between these two categories of user cannot be drawn, an evaluation based on the number of season tickets paid for risks overestimating the desired impact.
- The multiplier effect: When people achieve energy savings the example they set can generate other initiatives among these other people, even if they do not decide to apply for investment grants or tax relief. Given that our estimates are based on financial incentive application statistics, we will not cover these initiatives. In the same vein, it should be noted that the technical requirements for approving a grant can dictate how the technical measures are implemented. Thus, previously, a roof insulation installer invariably installed a thickness of 8 cm. Now that eligibility for an insulation grant requires a maximum coefficient of heat transfer to the insulated wall, a thickness of 20 cm is automatically installed.
- The rebound effect, where a device that consumes little energy tends to be used more often or in a more lax fashion. A well-known example is that of low-energy lamps that nobody takes the trouble to turn off.

The following conclusions can be drawn from these considerations:

- Impact estimates cannot be made for every measure of the plan.
- Where estimates are feasible, they will often be made for a series of measures (a cluster, for example) that share the same objective. Particular care must be taken to avoid double counting, and where this is unavoidable it should be identified.
- Estimates are marred by considerable uncertainties associated with the limited availability of data and the many assumptions that generally need to be considered to identify the baseline.
- It will be very difficult, if not impossible, to establish a link between the emissions reductions estimated here and the trends observed in the evolution of emissions inventories over time.
- In view of the large number of assumptions to consider participants must harmonise their work, together with the CONCERE Working Group, which is responsible for evaluating the impact of the plan's measures on improving energy efficiency, as required by the EU Directives 2006/32/*EC* and *2012/27/EU* on energy efficiency and services.

Methodologies used

The impact of measures, when possible, has been evaluated for projection years 2020, 2025, 2030 and 2035. Estimates benefit from existing statistics and indicators related to specific energy conservation or climate change policies. Among others:

- Benchmark and energy efficiency agreements in industry, monitored through energy efficiency improvement indicators (and their CO_2 counterparts);
- Statistics on green electricity production, generated green and CHP certificates ;
- Statistics on subsidies delivered to support energy saving investments in households;
- Statistics for public transports (train and buses): attendance and fuel consumptions.

Not all measures yield emission reductions that can be evaluated. Awareness campaigns, the establishment of facilitators or counselling offices, the accreditation of energy auditors… are examples of measures reputed beneficial, but whose quantitative impact is difficult to evaluate.

In some cases, information is just lacking. In many circumstances, the impact of individual measures cannot be estimated alone, while the global impact of clusters of measures, all aiming at a common target, can be evaluated[9].

As recommended, measures that are adopted or implemented and taken into consideration to establish a scenario "*with existing measures*" (WEM scenario) are categorised as 'WEM'.

Regions have approved their climate plans. In Flanders, the Climate Policy Plan 2013-2020 aims at emission reductions in the ESD sectors, some additional measures are being explored by the Government. In Wallonia, an Air and Climate Policy Plan has been approved, which provides an opportunity for the Government to reconsider priorities and objectives. In Brussels too, the Air, Climate and Energy Plan has come into force in June 2016.

All PAMs considered are categorized as "existing measures" (and taken into consideration in the "WEM" scenario). The different entities in Belgium are working on a national integrated climate and energy plan for the period 2021-2030. In the framework of this process, additional measures are being explored but are not yet sufficiently elaborated to be included in a WAM scenario.

[9] For instance, promoting public transports includes a series of measures aiming at improving the offer of public transports (comfort, speed, connectivity,...), others improving parking conditions around train stations, for cars and for bicycles, installing walkways and sidewalks in industrial areas, but also restricting and taxing parking conditions in downtown areas. The impact of each individual measure considered cannot be seized, but the whole cluster of measures contributes to a rise in attendance of public transports that can be measured.

4.3.4 Inventory table

Belgium's National Climate Plan consists of various measures, some of which reinforce each other and cannot therefore be evaluated individually. The effects of awareness and training measures are included in the measures they support and are not therefore listed in a separate evaluation.

The CTF Table 3 contains one row for each measure of the National Climate Plan (a more detailed version of CTF Table 3 is available on EIONET website. Some measures have been added, including those that can already be regarded as planned by the regional authorities, even if they have not yet published their final climate plan for 2020.

4.4 Policies and measures that are no longer applied

Compared to the previous report, the following PAMS were deleted from the summary table:

- EC-C05: Financial support for sustainable energy policies in sheltered and social workshops;
- EP-B01: ETS: specific policy for quotas allocation to electricity producers;
- EC-B04: Improvement of consumers information on the environmental impact of products; Flexibility mechanisms;
- EC-A02: Mobilizing the resources of the natural gas fund.

On the other hand, new PAMS have been introduced/proposed:

- Reduction of the emissions of fluorinated greenhouse gases (implementation ongoing);
- Positive Mobility allocation (proposal[10]) ;
- Fiscal incentives for the use of speed pedelecs for home-work transfer (to be implemented in 2018);
- Reduction of railways energy use (traction & non traction) (implementation ongoing);
- Modifying the fiscal regime for company cars (implemented since 2012);
- Low emission zone ;
- BatEx project.

[10] Measure aiming to establish a permanent system where workers whose wage package contains a company car can choose between a company car, a mobility budget, or a net salary increase. The net salary increase will be subject to similar fiscal rules as the actual company car.

4.5 Minimise adverse effects of response measures

Under Article 3.14 of the Kyoto Protocol and UNFCCC Decision 31/CMP.1, Annex I Parties are invited to report on how they are striving to implement their commitment while minimizing adverse social, environmental and economic impacts on developing country parties.

Actions taken are intended to contribute to preventing dangerous anthropogenic interference with the climate system. Adverse impacts of climate change are thus globally reduced when Annex I countries (and Belgium among them) take measures aiming to reduce GHG emissions through energy savings and the promotion of renewable energy sources. Furthermore, most of those actions contribute to reduce air pollution related to fossil fuel uses for the benefit of all countries.

Belgian policies and measures address not only fossil-fuel combustion but also emissions of all gases covered by the Kyoto Protocol, such as methane and nitrogen protoxide from agriculture and waste management or F-gases in refrigeration systems, thus ensuring a balanced distribution of efforts and limiting the potential impact of single measures that are too specific. As a Member State of the European Union, Belgium designs and implements most of its policies in the framework of EU directives, regulations, decisions and recommendations. For instance, Belgium has implemented the European liberalisation of electricity and natural gas markets and is involved in the European Emissions Trading Scheme, all actions aiming to address market imperfections and to better reflect externalities in energy/CO_2 prices.

Various international bodies have identified areas where progress could be made to decrease fossil fuel subsidies in Belgium.

Belgium has abolished subsidies supporting the use of coal and other fossil fuels for energy production and expects these measures to have a positive health impact on the long term. The Belgian agricultural policies and the promotion of biofuels are developed within the European common policies. The new EU common agriculture policy now tends to support quality products and environmental respect instead of large volumes of production, and should make market conditions more accessible to products from developing countries.

Concerning biofuels, acknowledging that their development could create pressures on food prices and on land and forest management, especially in developing

countries, the EU has established strict sustainability criteria which in particular include not supporting biofuels from land with high biodiversity value (primary forest and wooded land, protected areas or highly bio-diverse grasslands), or from land converted from wetlands, peatlands or continuously forested areas. It will also be very cautious about any broader environmental and social aspects such as air, water and soil quality and labour conditions.

Belgium also uses flexibility mechanisms, particularly in its participation in clean development mechanisms (CDM) projects. Actions in that domain include direct funding of projects or participation in carbon credit funds. The selection of CDM projects applies sustainability criteria based on the internationally recognized so-called "Gold Standards" checklist, addressing environmental aspects (including bio-diversity), social sustainability and development, quality of life and labour, and techno-economic aspects including employment and technological autonomy.

Finally, the respect and the promotion of human rights is and remains a priority for Belgium, both at the national level and in the relations with other countries.

Belgium is in various ways actively involved in the promotion and protection of human rights, e.g.:

- Establishment of a solid legal and policy framework for combating gender-based discrimination ;
- Support of the Office of the High Commissionner for Human Rights as a partner organisation of multilateral cooperation.
- Focus on the rights of women in the programming cycles of cooperation activities.
- Recent decision to work out a national action plan on business and human rights which will ensure the implementation of social responsibility and the anchorage of human rights within the business sector;
- Commitment to develop a 2nd national plan to combat child poverty;
- etc.

For more info, we refer to the 1st Belgian National Voluntary Review on the Implementation of the 2030 Agenda ("Pathways to sustainable development"). ■

5. Projections and the total effect of policies and measures, and supplementarity relating to Kyoto protocol mechanisms

5.1 Projections

5.1.1 Introduction

The projections described below are based on the 2017 Belgian submission to the European Commission in compliance with Articles 3 and 14 of Regulation (EU) No 525/2013. A detailed description of assumptions, parameters, sensitivity analyses and results is publicly available.

These projections were prepared in 2016 and 2017 using the most recent available emission data for the reference year 2014 as included in the inventory submission in 2016. In order to enhance transparency, the latest updated actual inventory data for the year 2015, as included in the inventory submission in 2017, have been used as starting point for this report.

The "With Existing Measures" (WEM) scenario includes implemented and adopted regional and federal measures at the end of 2016, for the projected Belgian greenhouse gas emissions over the period 2015-2035.

As described in Chapter 4, the different entities in Belgium are working on a national integrated climate and energy plan for the period 2021-2030. In the framework of this process, additional measures are being explored but have not yet sufficiently been elaborated to be included in a WAM scenario.

The reported WEM 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 of the different sectors (industry, domestic, tertiary, transport…) and results in sectoral energy projections. Within this approach, relations between energy consumption, activity levels and energy prices are assessed at a sectoral level.

The aggregated regional bottom-up projections are compared with national projections calculated by the Federal Planning Bureau (FPB) based on a macro-sectoral top-down econometric model (HERMES). These national top-down modelled projections are directly linked to macro-economic assumptions. A full description of the macro-sectoral top-down projections can be found in the projection report submitted to the European Commission

The greenhouse gas emission projections were elaborated in the course of 2016-2017 based on the most recent information available on the macro-economic context and policy implementation (see Chapter 4).

For more information, see also the Belgian national system on projections report under article 12 of Regulation (EU) No 525/2013 (MMR).

5.1.2 Description of models

Descriptions of the models used in the calculation of the regional and national projections are included in Annex 3 of this report.

The models used by the different entities are:

- EPM: used by the Walloon Region;
- Flemish energy and greenhouse gas simulation model: used by the Flemish Region;
- Energy and Atmospheric Emissions projection model for the stationary sources and Transport Emission Projection model: used by the Brussels Capital Region;
- OFFREM model: used by all regions for off-road sectors;
- HERMES model: used by the Belgian Federal Planning Bureau (i.e. macro-economic top-down approach).

All models used by the three regions are simulation models, 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. There are some minor differences with regard to the level of detail, the activity variables and parameters in these regional models. The projection results consist of the sum of the bottom-up projections (with the exception of the results of the macro-sectoral approach in Chapter 5.1.8). In order to avoid inconsistencies between the regions, the same general assumptions are used by the three regions for key parameters (climate assumptions, demographic evolution, …).

The strengths of these simulation models can be found in the ease of use, ease of understanding the results for decision makers, transparency, possibility to evaluate impact of single measures, … However, some weaknesses can be mentioned such as no guarantee of global optimum, difficulty to model complex (economic) interactions, involvement of expert judgement to define input variables, …

5.1.3 General projection assumptions

Since Belgium's last biennial report and national communication, the methodology has remained unchanged, while the input data has been updated.

The following general assumptions are used in the calculations of both the national top-down and regional bottom-up emission projections (unless otherwise indicated).

All currently implemented and adopted (EU, federal, regional) policies and measures are taken into account in the 'with existing measures' (WEM) scenario and are presented in more detail in the PAMs EU reporting template, an extended version of the CTF Table 3 and Chapter 4 of the present report.

The section below summarises the general assumptions of the WEM scenario. The national WEM projections are the sum of the Flemish, Walloon and Brussels projections. The electricity production and the bunker fuel consumption are 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 (transport volumes) while the national top-down CO_2 emission projections for road transport are based on fuel sales (see section "The Transport Sector (CRF category 1A3)"). To ensure coherence between national emission inventory data and projected regional emission data, the sum of the regional transport emission data is recalibrated to coincide with the 2015 national inventory. This recalibration has been integrated in the projected emission figures.

Emission factors

Emission factors reported in the 'Belgium's Greenhouse Gas Inventory (1990-2015) National Inventory Report have been used for the calculation of the projections.

Global Warming Potential

CO_2 equivalent emissions and projected emissions for 2015-2035 are calculated using the Global Warming Potential (GWP) values specified in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Climate assumptions

The regional bottom-up projections for the period 2015-2035 for the residential and tertiary sector are calculated assuming a number of degree-days equivalent to the average number of degree-days of the period 2006-2015: 1 807 degree-days (reference 15/15). The reported emissions of these sectors for the reference year 2014 correspond to the observed emissions (with 1 441 degree-days).

Demographic evolution

The demographic projections (CTF Table 5) are based on prospects presented in 2016 (DGSIE-ADSEI Bureau Fédéral du Plan-Federaal Planbureau, 2016) and take into account the observations of January 1st 2015.

CO_2 prices

CO_2 prices are especially relevant for the fuel choice in the electricity sector and industrial installations covered by the EU-ETS. A CO_2 price of EUR_{2013}15 for the year 2020 with a gradual increase to EUR_{2013}

Table 5.1: CO_2 prices

	2020	2025	2030	2035
EU ETS carbon price (EUR_{2013}/t CO_2)	15.0	22.5	33.5	42.0

Source: Recommended parameters for reporting on GHG projections in 2017, Final, 14/06/2016

Table 5.2: Electricity demand and supply for Belgium (TWh)

	Historical						Projected			
[TWh]	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
Final consumption	58.0	68.4	77.5	80.2	83.3	81.7	84.6	84.2	84.0	84.1
Pumped storage power stations balance (Pumping stations)	0.2	0.3	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4
Distribution losses	3.6	3.7	3.8	4.2	4.3	3.8	3.4	3.4	3.4	3.4
Net import (balance import-export)	-3.7	4.1	4.3	6.3	0.6	21.0	1.0	19.5	30.0	30.0
Net production	65.5	68.3	77.4	78.5	87.5	64.9	87.4	68.5	57.8	57.9

Source historical data: Eurostat database

42 for 2035 in the WEM scenario was suggested by the EC (Table 5.1). For the national top-down modelled projections of the Federal Planning Bureau this evolution of CO_2 price has been used.

5.1.4 Sector specific assumptions (regional bottom-up projections)

The following sector specific assumptions are used for the regional bottom-up 2017 projections.

The Power Sector (electricity production) (CRF category 1A1a and autoproducers in other CRF categories)

The projections for the electricity production sector are modelled with the Flemish energy and greenhouse gas simulation model at national level. Projections for the electricity production consider:

- the evolution of the electricity demand (in some sectors);
- the evolution of the electricity production park and production efficiencies;
- the import of electricity;
- fuel cost;
- time slices (electricity demand is not equal in winter and in summer, nor during night and day).

Table 5.2 shows the demand and supply data of the electricity sector for Belgium (TWh). Own use is considered indirectly through reduced net efficiencies of electricity plants in model calculations.

The demand and supply data show a slight increase of the final electricity con-

Table 5.3: Nuclear phase out (according to the law of 18th June 2015)

Nuclear unit	Capacity (MW)	Closing date
Doel 1	433	15th February 2025
Doel 2	433	1st December 2025
Doel 3	1 006	1st October 2022
Doel 4	1 039	1st July 2025
Tihange 1	962	1st October 2025
Tihange 2	1 008	1st February 2023
Tihange 3	1 046	1st September 2025

sumption between 2014 and 2035 with 2% (i.e. 0.1% per year on average). The trans-boundary electricity trading is considered exogenous in the modelling of the electricity production.

The net import levels in the Belgian projections up to 2035 are based on existing scenario reports of the Belgian power system (CTF Table 5). The actual evolution of the net-import will depend mainly on new trans-boundary transport capacities, commercial opportunities and the location of new production plants.

The WEM scenario integrates the phase-out of nuclear energy in Belgium. On the 18th of June 2015, another extension was approved (for the Doel 1 and Doel 2 units) through an amendment of the law of the 31st of January 2003. The timetable for the nuclear power phase-out between 2015 and 2025 mentioned in Table 5.3 (as inscribed in article 4 of this law) has been taken into account.

The offshore wind capacity is based upon a study by the Belgian transmission system operator (ELIA, 2016). The data for the WEM-scenario is based upon the "Elia-base scenario" (Table 5.4).

Table 5.5 shows the shares of nuclear, fossil fuel and renewables in total gross electricity production in the WEM scenario. Until 2025 a large part of the base load demand is projected to be met by nuclear power plants, CHP installations and renewable energy (biomass). After 2025, nuclear power plants will be phased-out and are projected to be mainly replaced by natural gas and increased imports. The share of renewables in total gross electricity production amounted to 19% in 2014 and increases to 49% in 2035. The policy and measures to support and promote renewable energy in the three regions and at the federal level are described in the PAMs reporting template.

For the CO_2 emission projections originating from waste incineration each region applies its own methodology as specified in the National Inventory Report. The CO_2 emissions from waste incineration with energy recuperation are reported in the energy sector as 'other fuels' for the non-organic part and as 'biomass' for the organic part. The emissions from 1 industrial waste incinerator in the Flemish region (auto-generator) are allocated to CRF category 1A4a.

Table 5.4: Offshore wind capacity WEM scenario (MW)

	2020	2025	2030	2035
WEM scenario	2188	2312	2312	2312

Table 5.5: Share of nuclear, fossil fuel and renewable in total gross electricity production

	Historical						Projected			
WEM scenario	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
Coal	28%	26%	19%	12%	6%	6%	0%	0%	0%	0%
Oil	2%	2%	1%	2%	0%	0%	1%	0%	0%	0%
Natural gas	8%	14%	19%	26%	33%	32%	22%	27%	45%	44%
Renewables	1%	2%	2%	4%	8%	21%	26%	41%	49%	49%
Nuclear	60%	56%	57%	55%	50%	37%	47%	27%	0%	0%
Other (including waste)	1%	1%	1%	1%	3%	4%	4%	5%	7%	7%

Source historical data: Eurostat database

The (Energy) Conversion Sector

Refineries (CRF categories 1A1a, 1A1b, 1B2c, 1B2a4)

Flanders

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 2014. The energy consumption of the refineries decreases between 2014 and 2035 taking into account the expected energy efficiency improvement. As described in the Belgian National Inventory Report CO_2 emissions of the refineries are allocated to the sectors:

- 1A1a for the involved combined heat-power installations of the refineries;
- 1B2c for the flaring emissions;
- 1A1b for the total emissions excluding the emissions of the combined heat-power installations and excluding the emissions from flaring activities.

All CH_4 emissions of this sector (except the emissions of the combined heat-power installations which are allocated to the sector 1A1a) are allocated in category 1B2a4 and all N_2O emissions (except the emissions of the combined heat-power installations which are allocated to the sector 1A1a) are allocated in category 1A1b. The emissions of CH_4 reported in the category 1B2a4 also contain the flaring activities of refineries.

Coke production (CRF category 1A1c)

Flanders

The scenario assumes one coke production plant in the steel industry operating at maximum capacity in the period 2014-2035 and equipped with a desulphurisation unit.

Wallonia

The last coke factory was closed in 2014 and it is not expected that a new plant will be built.

Oil transport (CRF category 1B2a3)

Flanders

Fugitive emissions of CO_2 and CH_4 from oil transport are assumed to remain constant at the 2014 level.

Gas transmission and distribution (CRF category 1B2b)

Flanders

Projections of fugitive CH_4 emissions from the distribution of natural gas 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. The expansion of the gas network is estimated taking into account the increase of the number of households and houses in areas with the possibility to connect to the distribution grid.

Wallonia

Calculation of CH_4 emissions from the distribution of natural gas in Wallonia is based on the assumption that the network does not experience further expansion. Pig iron pipes and asbestos cement pipes will continue to be replaced, all new distribution pipes being made of steel or PE/PVC.

Brussels-Capital Region

Fugitive emissions considered in Brussels-Capital Region are due to the distribution of natural gas; the emissions remain constant since the network will not be extended.

The Industrial Sector

Projections for the industry use assumptions of activities and sometimes also energy intensity.

Table 5.6 and and 5.7 present the assumptions used for the industrial CO_2 emissions projections for each region. For each major industrial sector, the assumed activity growth rates are mentioned until 2035.

Table 5.6: Activity assumptions for the industrial sector in Flanders (relative to 2014)

Sector	2014	2015	2020	2025	2030	2035
1A1b. Petroleum Refining	1.00	1.00	1.00	1.00	1.00	1.00
1A1c. Manufacture of Solid Fuels and Other Energy Industries	1.00	1.00	1.00	1.00	1.00	1.00
1A2a. Iron and Steel	1.00	1.00	1.00	1.01	1.01	1.02
1A2b. Non-Ferrous Metals	1.00	1.01	1.04	1.08	1.13	1.17
1A2c. Chemicals	1.00	1.01	1.06	1.11	1.17	1.26
1A2d. Pulp, Paper and Print	1.00	1.02	1.10	1.20	1.30	1.44
1A2e. Food Processing, Beverages and Tobacco	1.00	1.01	1.07	1.15	1.23	1.36
1A2f. Other	1.00	1.01	1.09	1.16	1.25	1.38

Table 5.7: Activity assumptions for the industrial sector in Wallonia (%/year)

Sector	Sub-sector	Activity variable				
		2014-2015	2015-2020	2020-2025	2025-2030	2030-2035
Steel	Electric steel	-3.15%	0.0%	0.0%	0.0%	0.0%
	Other steel enterprises	-6.9%	0.0%	0.0%	0.0%	0.0%
	Cogeneration	-100.0%	0.0%	0.0%	0.0%	0.0%
	Coke ovens	-100.0%	0.0%	0.0%	0.0%	0.0%
Cement	Grey clinker dry process	-1.7%	4.03%	6.4%	0.0%	0.0%
	Grey clinker wet process	-7.2%	8.5%	-100.0%	0.0%	0.0%
	White cement clinker wet process	-100.0%	0.0%	0.0%	0.0%	0.0%
	Cement production	1.1%	2.3%	0.0%	0.0%	0.0%
Lime	Lime production	3.7%	3.3%	0.0%	0.0%	0.0%
	Dolomite production	1.6%	1.5%	0.0%	0.0%	0.0%
	Other lime activities	0.0%	0.0%	0.0%	0.0%	0.0%
Glass	Flat glass	-11.1%	1.5%	1.6%	1.6%	1.6%
	Hollow glass	3.3%	2.3%	0.0%	0.0%	0.0%
	Glass fiber and glass wool	1.7%	2.6%	1.4%	1.4%	1.4%

Sector	Sub-sector	Activity variable				
		2014-2015	2015-2020	2020-2025	2025-2030	2030-2035
Chemical	Organic and inorganic chemicals	-2.6%	1.8%	1.5%	1.5%	1.5%
	Nitric acid	1.3%	1.0%	0.0%	0.0%	0.0%
	Parachemicals	-0.6%	2.3%	2.3%	2.3%	2.3%
	Ammonia	3.3%	2.2%	0.0%	0.0%	0.0%
	Other fertilisers (phosphates)	-3.6%	2.2%	0.0%	0.0%	0.0%
	Oxygen	-1.4%	1.8%	1.5%	1.5%	1.5%
	Cogeneration	-1.1%	1.8%	1.5%	1.5%	1.5%
Paper	Chemical pulp	5.7%	0.0%	0.0%	0.0%	0.0%
	Integrated graphic paper	5.7%	0.0%	0.0%	0.0%	0.0%
	Other graphic paper	5.2%	-0.5%	-0.5%	-0.5%	-0.5%
	Household paper	-1.4%	0.5%	0.5%	0.5%	0.5%
	Cogeneration	5.5%	0.0%	0.0%	0.0%	0.0%
Food industry		0.6%	1.9%	1.5%	1.5%	1.5%
Metal products		-8.3%	-4.8%	0.0%	0.0%	0.0%
Non ferrous metals		0.0%	0.0%	0.9%	0.9%	0.9%
Other industries		6.7%	1.2%	1.2%	1.3%	1.8%

Energetic CO_2 emission in the industrial sector (CRF category 1A2)

Flanders

Energy consumption and CO_2 emissions were modelled using expected energy efficiency improvement and activity projections for the different sub-sectors (Table 5.6). Both sets of assumptions are mainly based on the EU Reference Scenario 2016 (European Commission, 2016) for Belgium.

The industrial off-road emissions are calculated by using the OFFREM-model with emission factors of the IPCC 2006 guidelines (CO_2 and CH_4) and EMEP/EEA guidebook (N_2O). Off-road emissions of the industrial sectors are allocated (incl. construction industry) in category 1A2gvii.

Wallonia

Table 5.7 presents the assumptions made concerning the evolution of activity variables.

Between 2014 and 2016, rates of change of activities are based on statistics, estimates of market growths or perspectives of industrial sectors, investment projects and equipment closures that have occurred or have been announced.

Resulting rates are listed in the Table 5.7. After 2016, large installations are assumed to be maintained in activity. Expected structural changes are taken into account when known.

All major industries are involved in 'second generation' branch agreements in which they have committed to improve their energy/CO_2 efficiency by 2020. For the period 2014-2020, it was assumed that for each sector the improvement of energy efficiency and the reduction of specific CO_2 emissions up to 2020 will be those of the commitments contained in the sectoral agreement. For the period 2020-2035, an improvement in energy efficiency of 0.3 % per annum has been taken into account.

The assumptions on energy efficiency improvements are shown in Table 5.8.

For cogeneration, an improvement of specific consumption of fuel per MWhe of 0.5 % per annum for the period 2014-2020 and of 0.3 % per annum for the period 2021-2030 has been taken into account.

Brussels Capital Region

The projections are based upon energy intensity. The perspectives of future expansion are very low. The projections assume that the gross added value will progress according to the middle term projections 2016-2021 (FPB; IBSA; SVR; IWEPS, 2016); from 2022 until 2035 this value remains constant.

The 8th December 2016 a new decree has been approved concerning energy audits obligations[1]. This decree is included in the WEM scenario. The objective of this decree is to diminish about 5 % of total energy consumption of the biggest industrial companies located in the region. These companies account for approximately 50 % of total industry energy consumption.

[1] Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif à l'audit énergétique des grandes entreprises et à l'audit énergétique du permis d'environnement approuvé en troisième lecture le 8 décembre 2016.

Process emissions of CO_2 and non-energy use of fuels (CRF category 2A, 2B, 2C)

Flanders

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;

Table 5.8: Assumptions on energy efficiency improvements for the industrial sector in Wallonia

Sector	2014-2020 (%/year)	2021-2035 (%/year)
Steel	-0.75 %	-0.30 %
Chemicals	-0.81 %	-0.30 %
Cement	-0.15 %	-0.30 %
Lime	-0.55 %	-0.30 %
Glass	-0.34 %	-0.30 %
Food	-1.18 %	-0.30 %
Pulp & paper	-0.69 %	-0.30 %
Textile, wood & furniture	-0.16 %	-0.30 %
Other industry	-0.50 %	-0.30 %

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

It is assumed that climate policy will not have an effect on the non-energetic use of the fuels mentioned above.

There are also several chemical processes in which carbonaceous products, generally not considered as fuels, are oxidised to CO_2. Projections of CO_2 process emissions are linked to activity assumptions which mainly come from the EU Reference Scenario 2016 for Belgium.

Wallonia

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 the chemical industry;
- natural gas for ammonia production (carbon converted to CO_2 emissions)

Emissions from processes considered in Wallonia are the following:

- CO_2 produced by the decomposition of limestone in cement and lime productions;
- CO_2 produced by the decomposition of methane for the production of ammonia (and considered separately from CO_2 emitted by the actual combustion of methane)

Projections of CO_2 process emissions are linked to growth rates of activity (Table 5.7).

CH_4 and N_2O emissions in the industrial sector (CRF category 2)

The CH_4 and N_2O emission projections for the industrial sector are made using the emission inventory methodology reported in the National Inventory Report.

CH_4 emissions in the industrial sector originate mainly from the iron and steel sector in Flanders (sinter production). The same activity growth trend as mentioned in Tables 5.6 and 5.7 are assumed. The emission levels are directly linked with this same growth trend.

The N_2O emission originates from caprolactam (Flanders) and nitric acid (Flanders, Wallonia) production. N_2O emission projections of caprolactam production are based on information from the concerned company regarding activity data and implementation of reduction measures. N_2O emission projections of nitric acid production in Flanders is assumed to remain constant at the 2015 level.

In Wallonia, N_2O emission projections of nitric acid projections are based on information from the concerned company regarding activity data and implementation of reduction measures. Reduction measures were implemented in 2011, resulting in a large decrease of N_2O emissions.

F-gas emissions in the industrial sector (CRF category 2)

F-gas emission projections come from the model developed by ECONOTEC and VITO commissioned by the Federal Public Service of Public Health, Food Chain Safety and Environment (Econotec & VITO, 2015).

NF_3 emissions are only included in the total greenhouse gas projections. NF_3 is included neither as ETS nor as non ETS emissions since NF_3 is not covered by the European targets.

The Residential Sector (CRF category 1A4b)

The climate regulations and measures considered for the 2015 'with existing measures' projections are presented in more detail in CTF Table 3 (and in the PAMs reporting template). The assumed evolution of the population and the number of households is discussed in section 'Demographic evolution'. Estimates are made on the number of new dwellings. Distinction is made between new and existing houses.

Flanders

Heating and equipment

- New dwellings:

As of 2014 it is assumed that the heat demand of all new single-family dwellings and apartments respect an E-level of 60 following the implementation of the EC directive 2010/31/EU on energy performance of buildings (EPB). This E-level tightens gradually to 30 as of 2021 (Table 5.9).

- Existing dwellings:

For existing dwellings, projected fuel consumption is determined by the:

- average fuel consumption in existing dwellings in 2014 and evolution of dwelling numbers;
- impact of renewable energy policies (solar boilers and heat pumps), autonomous boiler efficiency improvements and also thermal insulation measures.

Fuel mix

The projected fuel mix of existing dwellings starts from the current distri-

Table 5.9: E-level pathway for the residential sector (2014-2021)

	2014	2016	2018	2020	2021
E-level	60	50	40	35	30

bution of energy carriers and takes into account the expected yearly fuel switch (from fuel oil to natural gas) and the number of heat pump installations. The fuel mix for new dwellings depends on the E-level pathway.

Equipment

It is considered that 80 % of the historic electricity was used for electrical appliances and lighting. The remaining 20 % was for heating and sanitary hot water. The evolution of the consumption of electrical appliances and lighting was simulated using the results of the EU Reference scenario 2016.

Off-road

Off-road emissions of the residential sector are calculated using the OFFREM-model with emission factors of the IPCC 2006 guidelines (CO_2 and CH_4) and EMEP/EEA guidebook (N_2O). Off-road emissions of the residential sectors are allocated to category 1.A.4.b.ii (Off-road vehicles and other machinery).

Wallonia

Heating

In the residential sector, the heat demand of all new dwellings takes into account the current EPB regulation in Wallonia, in force since 2012 with the different following requirements:

- 01/09/2011: $E_w = 80$; $E_{spec} = 130$ kWh/m²;
- 01/01/2017: $E_w = 65$; $E_{spec} = 115$ kWh/m²;
- 01/01/2021: $E_w = 45$; $E_{spec} = 85$ kWh/m².

where E_w is the "primary energy consumption level" and E_{spec} is the "specific primary energy consumption level".

For existing dwellings, the decrease of specific energy consumption has been calculated based on energy savings per type of renovation and the number of annual renovations. Due to a less favourable subsidies scheme in the Walloon region, the number of annual renovations taken into account for the period 2015-2030 is significantly lower compared to the period 2010-2014.

Table 5.10: Evolution of the number of annual renovations by type

	Roofs	Walls	Floor	Windows
2010-2014	15 000	4 000	2 000	10 000
2015	4 000	2 000	1 000	3 000
2016-2030	5 000	2 500	1 250	3 750

The number of renovations combined together with the energy savings per type of renovation lead to a decrease of the average specific consumption of existing housing of:

- 0.3 % per year for houses and 0.1 % per year for apartments between 2014 and 2020,
- 0.3 % and 0.1 % between 2021 and 2035.

The hot water consumption per dwelling is considered stable trough the period 2014-2035 which means that the hot water consumption per person increases slightly during the same period.

The performance of electric boilers and gas water heaters is considered to remain stable throughout the period. However, in the case of centralized production by the boiler, improved boiler performance is considered for hot water production (specific fuel consumption assumed to decrease by 9 % between 2012 and 2035). The share of electricity and fossil fuels to produce hot water is considered to remain stable over the projection period.

Electrical equipment

For equipment, it has been estimated that, in 2035, all of them will have specific consumption corresponding to the current best available technologies.

Fuel mix

The share of natural gas in fuel consumption is relatively constant over the period 2014-2035 (about 35 % for existing dwellings) while the share of fuel oil decreases slightly (51 % in 2014 and 48 % in 2035 for existing homes) to be compensated by wood (12 % in 2014 to 15 % in 2035).

Brussels-Capital Region

The residential emission projections consider the historic trends between 2001 and 2014 on energy consumption, household size, and population. The projections also reflect the application of the Brussels Capital Region Government's Decree[2] regarding Energy Performance of Buildings. This decree will start having an impact in 2018; it considers that all new buildings will be nearly passive (15 kWh/m².yr) and heavy renovated buildings will consume 30 kWh/m².yr.

The WEM scenario also includes the measures adopted in the Brussels Code on Air, Climate and Energy Control (COBRACE, French acronym) and the Air, Climate and Energy plan (PACE). The COBRACE reorganises the Brussels legislation in the areas with a cross-cutting approach. It includes measures towards improved air quality, energy performance of buildings, mobility and citizens awareness.

Measures included in the WEM scenario concern energy management and technical installations. The replacement of boilers is one of these measures. When a

[2] 21 décembre 2007.- Arrêté du Gouvernement de la Région de Bruxelles – Capitale déterminant des exigences en matière de performance énergétique des bâtiments et du climat intérieur des bâtiments tel que modifié par l'arrêté du 5 mai 2011.

new boiler is installed, the entire heating system must be controlled by a certified technician; which allows a 20% reduction in consumption. Boiler replacement rates were based upon data provided by the Thermal Technique Belgian Association (ATTB, French acronym) and was deduced from the boilers replaced with energy grants.

The second measure is also related to the heating installations. The mandatory control is applied for boilers that are part of a heating system with a nominal power higher than 20 kW that uses non-renewable fuel, and whose heat transfer fluid is water. An annual control is established for oil boilers and every three years for natural gas boilers. This control generates energy gains around 2% for gas boilers and 4% for oil ones. This measure lasts the whole projected period.

Another measure considered in the WEM scenario is the energy grant system. The energy gains are estimated considering the average gain of 2009 to 2014 for building's isolation, double glazing implementation, heating regulation systems and boilers replacement. The energy gain is considered to last 20 years. This gain is multiplied by the annual budget; the WEM scenario considers a constant budget from 2016 to 2020 of 22 M EUR. After that, the scenario considers the end of the grant system.

Energy gains due to the household's support are also estimated. This measure considers various actions realised by households thanks to the advice of the household's support. Actions like the replacement of shower heads towards an eco-shower, the insulation of pipes and hot water tanks, and the installation of thermostat or regulator clocks, among others are considered. For each action an average gain is estimated. The final energy gain is estimated using the number of interventions (advices). The WEM scenario considers 1750 interventions per year during the entire period (2015-2035). The gains are assumed to last 14 years (the average lifetime of the considered actions).

Finally, Brussels Capital Region promoted the "Exemplary Buildings Project" (BatEx) from 2007 to 2013. The objective of the project was to promote ecological construction and passive buildings. The project allowed the construction and renovation of approximately 214 000 m^2 in the residential sector. The energy gain is estimated to last 20 years.

The shift towards natural gas has been obvious during the years 2001-2014; this trend is maintained, representing 64% of heating consumption in 2030.

The Tertiary Sector (CRF category 1A4a)

Flanders

Energy projections are based on:

- the autonomous evolution of activity (based on added value) of the different subsectors;
- the implementation of energy saving measures as described in the PAMs reporting template
- the impact of renewable energy policies and autonomous boiler efficiency improvements.

In the subsector office buildings and education buildings, a tightening of the E-level is taken into account for new buildings (Table 5.9).

The projected fuel mix starts from the current situation and takes into account the expected annual fuel switch. A further increase of CHP is assumed in the tertiary sector.

Wallonia

The building stock having remained stable for the last three years, its growth until 2015 is assumed to be very moderate. For the whole projection period, its growth is 10.7%, slightly higher than the population growth (+9.9%).

It is assumed that during the period 2014-2035, 3% of existing buildings will be renovated annually, resulting in a saving of 20% of the fuel consumption between 2014 and 2020 and 10% between 2021 and 2035, and a saving of 10% of the electricity consumption over the whole period.

During the period 2014-2035, the shares of heating oil and natural gas are supposed to decrease slightly, from 31% to 27% for heating oil and from 64% to 63% for natural gas. Conversely, the share of wood is growing: to 6% in 2035.

Brussels-Capital Region

The main consideration for establishing projections is the expansion of building surface due to the increase of employment as well as the information available in the regional energy balance.

The implementation of the Brussels Energy Performance of Buildings Decree[3] is reflected in the projections. This measure is applied for office and education buildings; it starts in 2018. All new buildings are considered nearly passive (15 kWh m^2.yr) and

[3] 21 décembre 2007.- Arrêté du Gouvernement de la Région de Bruxelles – Capitale déterminant des exigences en matière de performance énergétique des bâtiments et du climat intérieur des bâtiments tel que modifié par l'arrêté du 5 mai 2011.

Table 5.11: E-level pathway tertiary sector (2014-2021)

	2014	2016	2018	2020	2021
E-level	60	55	50	45	40

all the heavily renovated buildings must reach a very low energy level (30 kWh/m².yr).

As for the residential sector, the measures included in the COBRACE and the PACE are part of the WEM scenario. The first measure focuses on the big energy consumers. It contemplates the requirement of an energy audit in order to obtain the renewal of the environmental permit for establishments exceeding 3 500 m² [4]. The energy audit allows a reduction of 12.5 % of final energy consumption.

The new decree concerning energetic audits has been approved on the 8th of December 2016[5]. According to this framework, the big companies, defined by the number of employees and its energy consumption, must do an energy audit starting in 2018, this means in average 9 additional audits per year. In addition, the target is enlarged for commercial establishments, starting from 2018; commercial establishments with a surface over 1 500 m² must do an energy audit.

Three measures already described in the residential sector scenario (see section 'The Residential Sector (CRF category 1A4b)') are also applied to the tertiary sector. The first one is the technical control of heating systems which has the same hypothesis than the residential sector. The second one is the implementation of the energy grant system; the only difference is the proportion of the budget assigned to this sector; according to the grant system report concerning the year 2013, the tertiary sector used 30 % of total budget and will be constant between 2016 to 2020. Finally, the BatEx project that (among others) promoted energy and environmental performance, profitability and reproducibility of the technologies was also applied in the tertiary sector. About 396 000 m² were constructed and renovated under this project between 2007 and 2013. The energy reduction obtained thanks this initiative is assumed to remain for 20 years.

The Agricultural Sector (CRF category 1A4c and 3)

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.

The livestock numbers mentioned in CTF Table 5 were used in the projections.

Flanders

In 2014 energy consumption in the agricultural sector mainly originates from greenhouse heating systems (40 %), non-stationary sources (fisheries, tractors...) (14 %) and the heating of stables (46 %).

Off-road emission projections are calculated using the OFFREM-model with emission factors of the IPCC 2006 guidelines (CO_2 and CH_4) and EMEP/EEA guidebook (N_2O). Emission projections of sea-fishery come from the EMMOSS model. Both models are also used for the greenhouse gas inventory.

The projections for greenhouse horticulture take into account the following technical measures, for which subsidies exist: fences, heat buffers, flue gas condensers, replacement of old boilers.

The CH_4 and N_2O emission projections take all policy measures, listed in the CTF Table 3, 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 (increase until 2015 due to abolition of the milk quota), stabilisation of the number of poultry and slight decrease of swine due to new regulation on investment support subject to manure management.

Wallonia

Energy related emissions, including the emissions from the gasoil of tractors and other mobile equipment, in the agricultural sector in the Walloon region are limited (< 3.5 PJ).

CH_4 and N_2O emission projections consider evolutions of livestock (all animal categories), agricultural area and mineral & organic fertilizer use. For some parameters, the mean values of the last years are maintained up to 2035, in absence of any other information (e.g. milk yield, crop residues...).

Brussels-Capital Region

Greenhouse gas emissions in agriculture mainly consist of CH_4 and N_2O emissions originated from animal husbandry (enteric fermentation and manure management) and direct and indirect emissions from managed soils. The agricultural emissions are very low in Brussels. The stabilisation of the sector is assumed since further expansion is not possible; thus the values remain constant.

The Transport Sector (CRF category 1A3)

General remarks regarding road transport projections

Projections for the road transport are performed combining 3 regional bottom-up calculations ("fuel used" basis). The sum of the three regional values for the reference year (2014) is then compared to the top-down data (or the "fuel sold" basis as reported in the Belgian CRF inventory data). Subsequently, the aggregated growth in the bottom-up models is applied to the difference between the bottom-up and top-down calculations (the so-called surplus), which is then allocated to the regions proportionally to their modelled emissions. Ultimately, the regional projections (including their respective shares of the sur-

[4] 30 janvier 2012.- Arrêté du Gouvernement de la Région de Bruxelles-Capitale rélatif à un audit énergétique pour les établissements gros consommateurs d'énergie.

[5] Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif à l'audit énergétique des grandes entreprises et à l'audit énergétique du permis d'environnement approuvé en troisième lecture le 8 décembre 2016.

plus) are added to each other to obtain the overall Belgian projection.

Biofuels

The share of biofuels in transport fuels is one of the important factors determining the emission levels. The shares of biofuels used in the regional road transport models are harmonized on the basis of this federal PAM. Table 5.12 provides an overview of the assumed blends of biodiesel in diesel and bioethanol in gasoline in the WEM scenarios.

Memo item international bunkers (aviation and navigation)

The emissions from international bunker fuels are based upon the latest available greenhouse gas inventory data at the time of performing the calculations (2014 emission data reported in April 2016). The trends from the Reference Scenario 2016 (EU Reference Scenario 2016) are applied to aviation bunker fuels, while the trends from the Federal Planning Bureau transport projection study (Federal Planning Bureau, 2015) are applied to the maritime bunker fuels. The international bunker emissions are reported as a memo item and hence are not included in the total greenhouse gas emissions.

Road transport activity

The road transport activity for Belgium (CTF Table 5) is the sum of the regional activity numbers which are explained in more detail further on.

Vehicle fleet composition

The shares of the different technologies in the Belgian vehicle fleet are provided in Table 5.13. They are based upon the fleet compositions of the three regions, which are described in more detail in the remainder of this chapter.

Apart from the harmonized shares of biofuels in road transport and international bunkers, the rest of the transport sector modelling occurs through specific regional models. These are described below.

Flanders

Different models were used for the various transport modes (road transport, railway transport, inland shipping, maritime shipping and aviation). The models calculate the use of energy and the emissions starting from the transport flows (volumes). For road traffic, railway traffic and inland shipping the specialised Flemish multimodal traffic model was used to calculate the transport flows.

Road transport

The calculation of atmospheric pollutants emissions and energy consumption for road transport is based on projection studies performed by VITO for the Flemish government in 2016. The European COPERT IV[6] approach was used in these studies. Only motorized traffic is included in the projections.

The WEM scenario includes the nationally and regionally planned improvements of the public transport network, the

[6] Version 11.2

Table 5.12: Overview of the assumed energetic shares of biofuels in transport fuels in the WEM scenario* (% Net Calorific Value)

		Historical			Projected		
		2007**	2010	2015	2016	2017-2019	2020-2035
WEM	bioethanol	0.0	4.3	2.7	2.7	5.7	5.7
	biodiesel	1.3	4.1	3.0	5.5	5.5	5.5

* Since the realisation of the current projections, new studies have taken place, and hypotheses made in the PAM evaluation documents are slightly different.
** Biofuel blending started in 2007.

Table 5.13: Passenger car fleet composition by technology (1990-2035)

	Historical				Projected			
	2000	2005	2010	2015	2020	2025	2030	2035
Diesel	40.5%	50.1%	61.2%	61.5%	59.8%	56.6%	54.7%	54.2%
CNG	0.0%	0.0%	0.0%	0.0%	0.5%	1.4%	2.3%	2.9%
Petrol	58.1%	48.7%	38.1%	37.5%	35.6%	33.0%	29.8%	26.7%
Petrol hybrid	0.0%	0.0%	0.1%	0.6%	2.9%	6.6%	9.5%	11.3%
LPG	1.4%	1.2%	0.7%	0.3%	0.2%	0.2%	0.2%	0.2%
Diesel Hybrid	0.0%	0.0%	0.0%	0.1%	0.5%	1.0%	1.5%	1.8%
Electric	0.0%	0.0%	0.0%	0.1%	0.4%	1.1%	1.9%	2.6%
Fuel Cell H_2	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%

Source historical data: Transport database Federal Planning Bureau

redesign of some urban areas to promote soft transport modes (walking, cycling), and the implementation of trucks freight transport pricing. No new Flemish measures are assumed in the WEM scenario after 2018. Starting from the base year 2014, the expected evolution of mobility and transport demand in Flanders in the WEM scenario was used to calculate the number of vehicle kilometres per vehicle type and fuel type for the period 2015-2035. The future vehicle fleet for new cars (with a shift to mainly charge-sustaining hybrids and to a lesser extent to plug-in hybrids and electric vehicles) and light duty vehicles (with a slight shift to alternative fuels and drivetrains), and further energy-efficiency improvements in the period 2020-2030 were taken into account to comply with the European Regulations on CO_2 from passenger cars and light duty vehicles (EC No 443/2009 and EC No 510/2011). The total Flemish fleet composition was modelled for the period 2015-2035 starting from the fleet in 2014 and considering the composition of new vehicles and survival rates of the vehicles over the same period.

Energy mix

For passenger cars there is a small but significant shift from fossil fuels to biofuels and electric/plug-in hybrid vehicles. By 2035, approximately 17.6% of the passenger car fleet is projected to be composed of electric, plug-in hybrid or charge-sustaining hybrid vehicles. In the projection, the share of hydrogen-powered vehicles remains very limited. Including the shares of charge-sustaining and plug-in hybrid vehicles diesel and petrol vehicles represent 54.6% and 41.3% of the car fleet respectively.

Rail transport

Emissions of rail transport only include the emissions originating from diesel trains, while energy figures include energy use by electric trains as well. The applied growth in transported volumes determines train-kilometers, which in turn determine the evolution of the emissions. The shares of diesel and electric traction are considered constant over the projected period. The evolution of the transported volumes is based on one of the most plausible scenarios of the Flemish mobility plan, which is currently under development.

Inland Waterways and Short-sea Shipping

Emissions of inland waterways and short-sea shipping are based on the evolution of the transported volumes under the same scenario as rail transport.

Off-road emissions

Emission of off-road activities in harbours, airports and transhipment companies are allocated to CRF category 1A3e. The emissions projections are calculated with the country-specific OFFREM-model with emission factors of the IPCC 2006 guidelines (CO_2 and CH_4) and EMEP/EEA guidebook (N_2O).

Pipeline transport

Emissions originating from the compression activities in the sector 'storage and transport of natural gas' are reported in CRF category 1A3e. The emissions are assumed to remain constant at 2014 levels.

Wallonia

Road transport

The Walloon projections for road transport are established on the principle of:

"emission =
mobility (vkm) x emission factor (t/vkm)"

where:

- The projections of the overall mobility are calculated using the principle of mobility demand (projections of the Federal Plan Bureau (FPB)
- The projections of the vehicle fleet are calculated using survival curves based on the historic inventory data.
- The emission factors are calculated from the historic inventory data (year 2014)
- Emission factors for new technologies are established assuming improvements expressed in% with regards to existing technologies.

Conventional vehicles remain the main technologies operating up to 2035. By 2035, diesel conventional vehicles still represent 51.5% of the total sales of cars (65.1% in 2014). Petrol cars represent 23.7% (32.5% in 2014). Hybrid models (diesel and petrol) penetrate the fleet, with 8% of the sales by 2020 (1.6% in 2014) and 13% by 2035. CNG cars represent also 5% of the sales by 2035.

Heavy duty diesel vehicles remain dominant (98-99% of the sales throughout the projections).

Rail transport

GHG emissions from rail transport are essentially due to the transport of goods, representing some 70% of the fuel consumption. They have decreased from some 70 kt CO_2 in 2006 down to 29 kt CO_2 in 2014. We assumed they would stabilize at that level until 2035.

Inland vessels

GHG emissions from inland vessels have been relatively constant for the last 8 to 10 years, around 50-55 kt CO_2/year. They are assumed to remain around that level until 2035.

Brussels-Capital Region

Projections of transport emissions consider road and off-road transport, railways, inland navigation, and natural gas transport. Road transport emissions represent 98.5% of the total GHG emissions of transport (in 2014). The main hypotheses are described in the following paragraphs.

Road transport

The calculation of atmospheric pollutants emissions and fuels consumption for road transport is based on the European COPERT IV approach. The main input

data required for COPERT simulations (vehicles fleet and mobility) comes from a regional transport model, developed on the basis of literature data (TML, 2006) (INRETS, 2004), and recalibrated to the actual situation in the Brussels Region using emission inventories and outputs from a detailed traffic model (MUSTI).

The policies and measures taken into account for the simulations refer to WEM scenario. The measures include the planned improvements of the public transport network, the redesign of some city areas to promote walking and cycling, and the implementation of trucks freight transport pricing.

For road transport, the WEM scenario also considers the implementation of a Low Emission Zone (LEZ), at the regional level, which implies that the vehicles that do not respect the established thresholds (based on EURO standards) are banned. This measure has a significant influence on some pollutants affecting local air quality, but a rather limited impact on GHGs emissions and climate change.

Companies with more than 100 employees in the same site must elaborate a mobility plan which must be updated every 3 years. The objective is to promote the shift to more sustainable transportation modes and to reduce traffic and congestion. Finally, the last measure considered in the WEM scenario is the promotion of car sharing, as alternative to personal car ownership. There are various systems of car sharing: round trip, one way or free floating. The PACE established an objective of 20 000 clients in BCR at the 2020 horizon which implies the availability of 800 cars.

Rail transport

For railways, the evolution of gasoil consumption is derived from the evolution of freight transport demand (FPB, 2014). Passengers transport (trains, metro and tramways) is driven by electricity; the transport supply (and the corresponding electricity consumption) increases by 70 % between 2012 and 2025, together with the expected finalization of the express regional network (RER, French acronym).

Navigation

For inland navigation, the evolution of liquid fuel (gasoil) consumption is derived from a reference scenario of transport demand for Belgium (FPB, 2014).

Natural gas transport

The emissions of natural gas transport are kept constant and equal to the emissions of year 2014 for the entire projection period since there are no projections available for this sector.

Off-road emissions

Projected off-road emissions for all sectors and vehicle categories come from the OFFREM model.

The 'Other product manufacture and use' Sector (CRF category 2G)

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

Flanders

N_2O emissions from this use are kept constant at 2014 emission levels. The last historic value has been considered constant for the entire projection period.

Brussels-Capital region

The use of N_2O as anaesthetic and aerosol cans are included in this category. The information on anaesthetic use is based on the regional sales of anaesthetic. The last historic value has been considered constant for the entire projection period. Emissions due to the use of aerosol cans are also estimated in the BCR inventory considering a constant consumption per inhabitant. The emission projections of aerosol cans are based on population data from the FPB (see section 'Demographic evolution').

Non-energy products from fuels and solvent use (CRF category 2D)

Flanders

The emissions of non-energy products from fuels and solvent use are considered constant at the 2014 level for the entire projection period.

Wallonia

The emissions of non-energy products from fuels and solvent have remained stable for 10 years. Those emissions are kept constant for the entire projection period.

Brussels-Capital Region

The use of lubricants is kept constant for the entire period.

The Waste Sector (CRF category 5)

Flanders

Projections of CH_4 emissions from the solid waste disposal on land (CRF category 5A) are calculated taking into account a ban on organic waste dumping since 2000. 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 (CRF category 1A1a and 1A4a).

CH_4 and N_2O emissions from waste water handling in Flanders (CRF category 5D) are based on projections with respect to the evolution of population and of the number of people connected to waste water handling systems until 2035.

CO_2 emissions from municipal waste water treatment are set to zero in the projections because these emissions derive from biomass raw materials.

As mentioned in section 'The Power Sector (electricity production) (CRF category 1A1a and autoproducers in other CRF categories)' the projections of the waste incineration plants with energy recuperation are allocated to the energy sector.

CO_2 emissions from flaring in the chemical industry are allocated to the waste sector (CRF category 5C) and are assumed to remain constant at the 2014 level.

CH_4 emissions from composting (CRF category 5B) are kept constant at current emission levels.

Wallonia

Projections of CH_4 emissions from solid waste disposal on land consider the Order of the Walloon Government of 18/3/2004 banning the dumping of municipal waste into landfills since 1/1/2008, yielding a decline of degradable organic carbon content (municipal waste being mainly organic).

Nevertheless, the amount of total waste disposed is considered constant and equal to the average of the 2010-2015 period (conservative hypotheses). The methodology used for calculation is the one described in the last 2006 IPCC guidelines. The recovery rate of landfill gas is assumed to remain constant at its level of the average of the period 2010-2016. 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.

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 solid waste, incineration of hospital waste and flaring in the chemical industry. 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 and N_2O emissions from composting in Wallonia are kept constant at current emission levels.

Brussels-Capital Region

For the waste water handling emissions, only the N_2O emissions are considered in the projections since the biogas produced is used in a CHP installation. Projections are based on the population evolution (see section 'Demographic evolution'). The compost centre started in 2002 and emissions from composting are kept constant for the projected period. The waste incinerator of Neder-Over-Heembeek is not included in the waste sector as due to the energy recovery process. It is included in the energy sector.

The Land-Use and Land-Use Change and Forestry Sector (CRF category 4)

The projections for the LULUCF sector are based upon the 2016 version of the EU Reference scenario prepared for the Directorate-General for Energy, the Directorate-General for Climate Action and the Directorate-General for Mobility and Transport (EU Reference Scenario 2016) for CO_2 emissions and sinks. For N_2O emissions, the 2014 levels were applied for the entire projection period.

Table 5.14: Differences in demographic projections (NC7/BR3 versus NC6/BR2)

	Demographic projections				
	2015	2020	2025	2030	2035
NC7/BR3 (2018)					
Population Belgium (thousands)	11 519	11 756	11 989	12 208	11 519
Number of households Belgium (thousands)	5 019	5 155	5 296	5 436	5 019
Average household size Belgium	2.30	2.28	2.26	2.25	2.30
BR2 (2016)					
Population Belgium (thousands)	11 221	11 489	11 716	11 895	12 038
Number of households Belgium (thousands)	4 848	5 038	5 166	5 274	5 372
Average household size Belgium	2.31	2.28	2.27	2.26	2.24
NC6 (2014)					
Population Belgium (thousands)	11 419	11 888			
Number of households Belgium (thousands)	5 065	5 365			
Average household size Belgium	2.26	2.22			

5.1.5 Differences in methodology and assumptions

There have been no significant changes in the modelling tools and methodologies since the last reporting of the national communication and biennial report.

The main differences in assumptions are:

- a different time horizon (2020-2035 in NC7/BR3 versus 2015-2035 in BR2 and 2015-2020 in NC6);
- a new base year (2014 in NC7/BR3 versus 2012 in BR2 and 2010 in NC6);
- 2006 IPCC inventory guidelines were used in NC7/BR3/BR2 whereas 1996 IPCC guidelines were used in NC6;
- different climate assumptions (1 807 degree-days in NC7/BR3 versus 1 819 degree-days in NC6 and 1 864 degree-days in BR2 using reference 15/15);
- more recent demographic projections based on prospects presented in 2016 by the Federal Planning Bureau (Table 5.14).
- the timetable for the nuclear power phase-out has undergone some changes during the last few years (Table 5.15):
  - On the 31st of January 2003, the Federal Government decided the progressive phase-out of the production of electricity using nuclear fission energy by limiting the operating lives of existing nuclear power plants to 40 years and prohibited the construction of new nuclear power plants. The WEM projections in NC6 were based on this phase-out scenario.
  - In July 2012, the Federal Government confirmed this timetable except for one nuclear unit, Tihange 1, whose operation lifetime was extended by 10 more years. This decision was confirmed in a law (18th of December 2013).
  - In 2013 the Government decided to extend the operation lifetime of Doel 1 and Doel 2 (by 10 years) as well. However, at the time of the BR2 reporting this decision was still subject to the agreement of the owner of these two power plants and to the approval of the Federal Agency for Nuclear Control (FANC). This extension has been considered as a sensitivity analysis in BR2.
  - On the 18th of June 2015, another extension was approved (for the Doel 1 and Doel 2 units) through an amendment of the law of the 31st of January 2003. This amendment has been taken into account in the WEM scenario in NC7/BR3.
- activity assumptions for industrial sectors were adapted to more recent economic projections;
- assumptions for the buildings now include the new policy initiatives up to and including 2016;
- livestock numbers have been adjusted based on more recent information (Table 5.16).

Table 5.15: Differences in nuclear phase-out assumptions

Nuclear unit	Capacity (MW)	NC7/BR3 (WEM)	BR2 (WEM)	BR2 (sensitivity analysis)	NC6 (WEM)
		Closing date	Closing date	Closing date	Closing date
Doel 1	433	15th February 2025	15th February 2015	15th February 2025	15th February 2015
Doel 2	433	1st December 2025	1st December 2015	1st December 2025	1st December 2015
Doel 3	1 006	1st October 2022	1st October 2022	1st October 2022	1st October 2022
Doel 4	1 039	1st July 2025	1st July 2025	1st July 2025	1st July 2025
Tihange 1	962	1st October 2025	1st October 2025	1st October 2025	1st October 2015
Tihange 2	1 008	1st February 2023	1st February 2023	1st February 2023	1st February 2023
Tihange 3	1 046	1st September 2025	1st September 2025	1st September 2025	1st September 2025

Table 5.16: Differences in livestock numbers (NC7/BR3 versus NC6/BR2)

Animal numbers (thousands)	2015	2020	2025	2030	2035
NC7/BR3 (2018)					
Dairy cattle	439	426	414	398	398
Non-dairy cattle	2 093	2 023	1 918	1 822	1 822
Sheep	116	113	101	138	138
Swine	6 514	6 488	6 245	6 085	6 085
Poultry	38 628	39 414	39 618	40 506	40 506
BR2 (2016)					
Dairy cattle	549	597	586	594	596
Non-dairy cattle	2 006	2 025	2 055	2 067	2 067
Sheep	120	148	188	210	218
Swine	6 591	6 439	6 256	5 977	5 854
Poultry	35 422	36 662	36 238	36 421	36 268
NC6 (2014)					
Dairy cattle	581	549	n.a.	n.a.	n.a.
Non-dairy cattle	1 989	2 043	n.a.	n.a.	n.a.
Sheep	100	96	n.a.	n.a.	n.a.
Swine	6 806	6 786	n.a.	n.a.	n.a.
Poultry	33 592	33 363	n.a.	n.a.	n.a.

5.1.6 The 'with existing measures' greenhouse gas emission projections

Overall results

Table 5.17 summarises the compiled 'with existing measures' projections for the period 2020-2035 and the inventories for the period 1990-2015. More detailed information on these projections can be found in the projections template reported under article 14 of Regulation (EU) N° 525/2013. More aggregated projection results are included in CTF Table 6.

Table 5.17: Total WEM GHG emissions projections

CRF format (Mton CO_2-eq)	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
1 Energy	103.5	107.4	105.8	105.3	98.3	86.3	83.8	82.5	85.5	85.9
1A Fuel combustion	102.3	106.6	105.0	104.6	97.6	85.7	83.2	81.9	84.9	85.2
1A1 Energy industries	30.1	29.6	28.7	29.4	26.5	21.3	18.4	17.2	19.9	19.8
1A2 Manufacturing industries and construction	23.2	22.9	21.5	18.7	15.7	13.6	13.8	13.4	13.2	13.1
1A3 Transport	20.7	22.7	24.6	26.4	26.2	26.5	27.2	28.1	29.2	30.4
1A4 Commercial / residential / agriculture	28.1	31.2	29.9	30.0	28.9	24.1	23.7	23.1	22.5	21.9
1A5 Other	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0
1B Fugitive emissions from fuels	1.2	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.6
1C CO_2 transport and storage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 Industrial processes	26.2	30.2	28.4	26.4	21.4	19.5	19.9	19.1	18.6	18.3
3 Agriculture	12.2	12.3	11.4	10.3	10.2	10.0	9.6	9.2	9.1	9.1
4 Land-Use Change and Forestry	-2.8	-2.6	-2.2	-3.5	-1.9	-1.9	-3.7	-3.7	-3.8	-3.9
5 Waste	4.3	4.5	3.9	3.1	2.5	1.6	1.4	1.1	1.0	0.9
Total excluding LULUCF	**146.3**	**154.3**	**149.5**	**145.1**	**132.4**	**117.4**	**114.7**	**111.9**	**114.1**	**114.1**
Memo item international bunkers - aviation	**2.5**	**2.9**	**4.7**	**3.6**	**4.2**	**4.2**	**4.2**	**4.3**	**4.5**	**4.9**
Memo item international bunkers - navigation	**13.3**	**13.0**	**16.2**	**25.2**	**24.9**	**18.1**	**20.7**	**22.5**	**23.7**	**24.9**

Non-ETS results

Table 5.18 provides the non-ETS emissions projections starting from 2015. There are no comparable time series of the non-ETS emissions available since the ETS system has only been set up in 2005 and scope extensions have been introduced in 2008 and 2013.

Table 5.18: WEM total non-ETS GHG emissions projections

CRF format (Mton CO_2-eq)	2015	2020	2025	2030	2035
1 Energy	56.6	56.7	56.8	57.1	57.7
1A Fuel combustion	56.0	56.2	56.3	56.6	57.2
1A1 Energy industries	2.5	2.0	1.9	1.9	1.9
1A2 Manufacturing industries and construction	3.0	3.4	3.4	3.2	3.2
1A3 Transport	26.4	27.1	28.1	29.1	30.3
1A4 Commercial / residential / agriculture	24.1	23.6	22.9	22.3	21.7
1A5 Other	0.1	0.0	0.0	0.0	0.0
1B Fugitive emissions from fuels	0.5	0.5	0.5	0.5	0.5
1C CO_2 transport and storage	0.0	0.0	0.0	0.0	0.0
2 Industrial processes	4.8	3.6	2.8	2.2	1.7
3 Agriculture	10.0	9.6	9.2	9.1	9.1
4 Land-Use Change and Forestry	-1.9	0.0	0.0	0.0	0.0
5 Waste	1.3	1.1	0.9	0.7	0.7
Total excluding LULUCF	**72.7**	**71.0**	**69.7**	**69.2**	**69.2**

5.1.7 Comparison with the macro-sectoral top-down approach[7]

Evolution of total GHG emissions

The national modelled GHG emission projections calculated by using the top-down econometric model HERMES are presented in Tables 5.19 and 5.20.

Differences between bottom-up and top-down results are due to different expectations when building the models and to different ways these models respond to assumptions. For instance, macro-economic models such as HERMES are more sensitive to price variations than technical-economic models.

Table 5.19: Evolution of total GHG emissions (in Mt CO_2-equivalents)

	2005[a]	2010[a]	2014[a]	2015[b]	2020[b]	2025[b]	2030[b]
Total of the CO_2 emissions	125.1	114.2	96.3	99.1	90.2	95.2	92.2
Total of the CH_4 emissions	9.1	8.6	8.0	8.1	8.0	8.1	8.3
Total of the N_2O emssions	8.6	7.8	6.3	6.2	5.8	5.6	5.3
Total of the fluorinated gases	2.0	2.7	3.2	3.2	3.2	3.1	3.1
Total GHG emissions	**144.8**	**133.3**	**113.9**	**116.6**	**107.2**	**112.0**	**108.9**

Table 5.20: Evolution of total GHG emissions per sector (in Mt CO_2-equivalents)

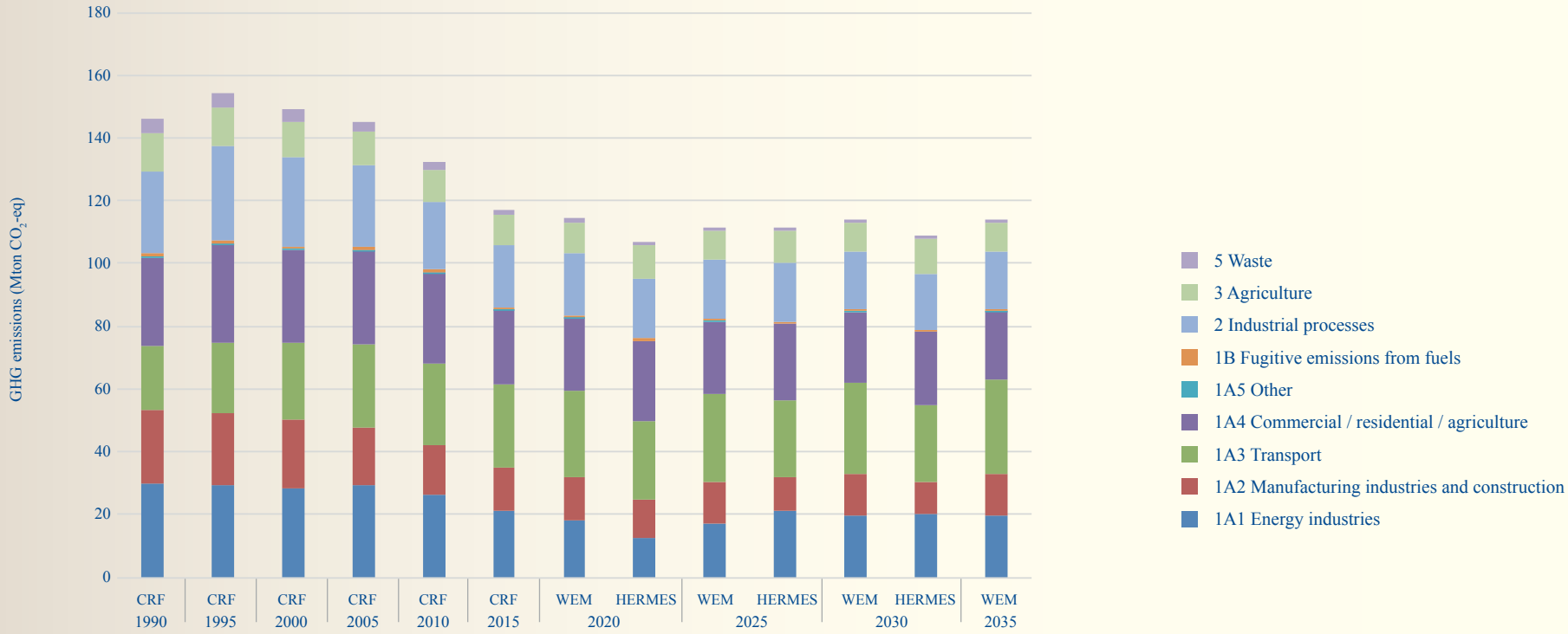
	2005[a]	2010[a]	2015[b]	2020[b]	2025[b]	2030[b]
1. Energy	105.0	99.0	84.6	76.4	81.8	79.1
1A. Fuel Combustion	104.4	98.4	84.0	75.7	81.1	78.4
1A1. Energy Industries	29.6	23.3	18.0	12.5	21.2	20.4
1A2. Industry	19.3	18.3	13.5	12.7	11.1	10.1
1A3. Transport	26.2	26.9	25.9	24.7	24.5	24.6
1A4. Other sectors	29.2	29.9	26.5	25.7	24.2	23.3
1A5. Other	0.1	0.1	0.0	0.0	0.0	0.0
1B. Fugitive emissions	0.6	0.6	0.6	0.7	0.7	0.7
2. Industrial processes	26.4	21.4	20.2	19.2	18.5	18.0
3. Agriculture	10.2	10.2	10.0	10.3	10.5	10.8
5. Waste	3.2	2.7	1.7	1.4	1.1	1.0
Total GHG emissions	**144.8**	**133.3**	**116.6**	**107.2**	**112.0**	**108.9**
Non-ETS	**78.6**	**78.9**	**72.3**	**69.4**	**68.5**	**67.5**
ETS (scope 2013-2020)	**66.2**	**54.4**	**44.3**	**37.8**	**43.5**	**41.4**
International bunkers	**28.8**	**29.1**	**22.2**	**24.6**	**27.0**	**29.2**

a: National GHG Emission Inventory of April 2016, CO_2 emissions from fuel combustion are calculated endogenously by HERMES
b: HERMES calculations

[7] Projections of GHG Emissions by 2030 for Belgium – October 2016 – Federal Planning Bureau, Bracke & Vanhorebeek. (full description included in chapter 6 of the 2017 projections report).

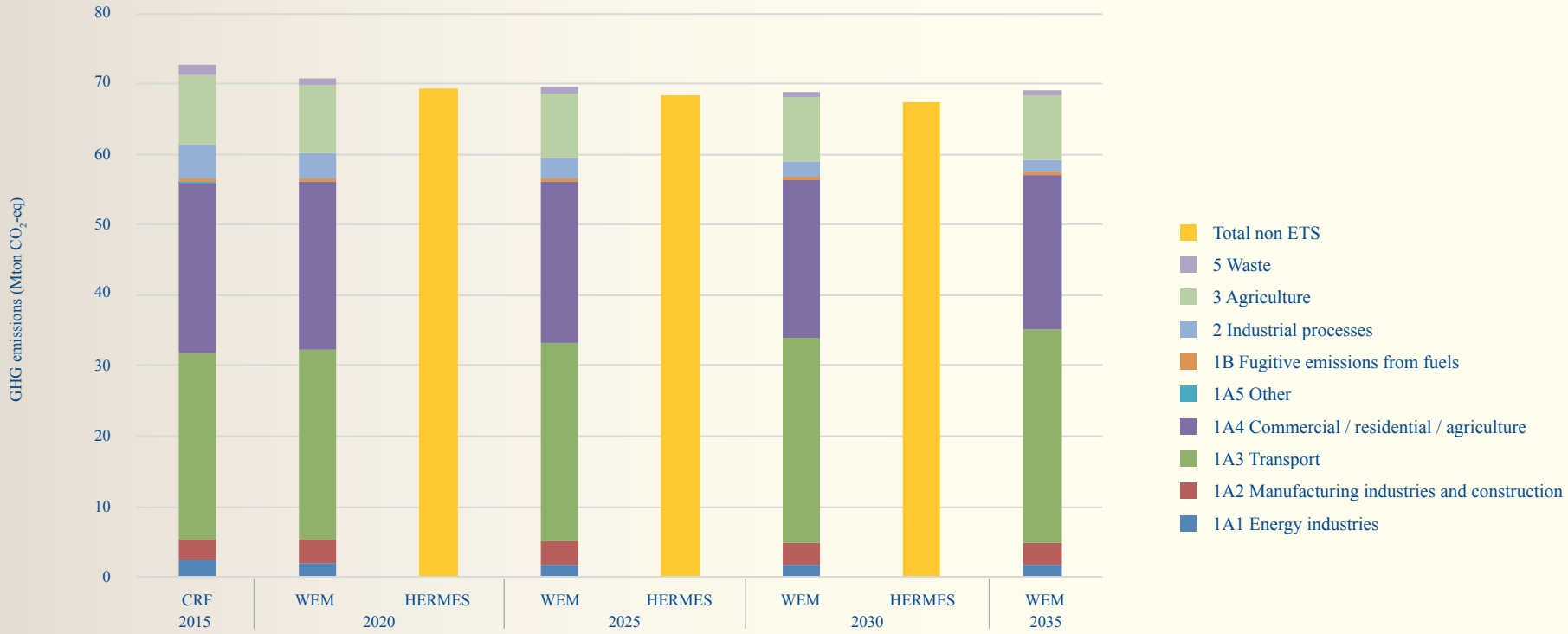
The top-down HERMES projections result in a decrease of total emissions between 2015 and 2030 with 5 Mton while the bottom up projections show a smaller reduction in this period. The resulting trends for the different sectors are very different between the two modelling approaches (Figure 5.1).

Figure 5.1: Evolution of total GHG emissions excluding LULUCF
(regional bottom-up projections versus macro-sectoral top down projections)



The non-ETS emissions resulting from both models show similar trends in the period 2015-2030 (Figure 5.2).

Figure 5.2: Evolution of non ETS GHG emissions excluding LULUCF (regional bottom-up projections versus macro-sectoral top down projections)



5.1.8 Sensitivity analysis of the 'with measures' greenhouse gas emission projections

Sensitivity analyses are performed for some important parameters such as number of degree-days and import of electricity. Indirect effects, however, are not taken into account.

Number of degree-days

The weather (mainly temperature) has an important role in energy consumption for the residential and tertiary sector. The WEM scenario is based on a mild climate that has been established considering the number of degree-days equivalent to the average values for the period 2006-2015 (i.e. 1 807 degree-days). To identify the impact on the energy consumption of colder or warmer weather, the sensitivity analysis is made for three scenarios:

- Average of 25 years (1985-2009) as in the energy efficiency action plan: 1 946 degree-days.
- Warm year: 1 441 degree-days (2014)
- Cold year: 2 145 degree-days (2013)

In case the future climate would be milder (1 441 degree days), CO_2 emissions from buildings would be 2 109 kton CO_2 lower in 2020 and 1 935 kton CO_2 lower in 2030. In case of much colder climate (2 145 degree-days) emissions would be 1 760 kton CO_2 higher in 2020 and 1 650 kton CO_2 higher in 2030. For 2020, the emission impact of a warm year and the colder climate (compared with the average of 1 807 degree days) represent respectively 2.6 % and 3.1 % of the Annual Emission Allocation for 2020. Hence, climate could have a significant impact on the future commitments for the non ETS sector.

Table 5.21: Sensitivity analysis of CO_2 emissions (kton) for degree-days in 2020

	1 807 degree-days	1 441 degree-days	2 145 degree-days	1 946 degree-days
Tertiary sector	5 330	4 993	5 600	5 446
Residential sector	15 764	13 992	17 254	16 387
Total	21 094	18 985	22 854	21 833

Table 5.22: Sensitivity analysis of CO_2 emissions (kton) for degree-days in 2030

	1 807 degree-days	1 441 degree-days	2 145 degree-days	1 946 degree-days
Tertiary sector	5 158	4 842	5 417	5 271
Residential sector	14 726	13 107	16 118	15 309
Total	19 884	17 949	21 534	20 580

Import of electricity

The trans-boundary electricity trading is considered exogenous in the modelling of the electricity supply. The import levels in the Belgian projections up to 2035 have been based on existing scenario reports on the Belgian power system. The evolution of the net-import will mainly depend on interconnection capacities, commercial opportunities, the availability of power production in neighbouring countries, and the investments in new power production plants in Belgium. In order to analyse the impact of these uncertainties, a sensitivity analysis to the net import level of electricity has been made.

An import level of 30 TWh was taken into account in the base scenario in 2030. The impact of lower import levels on CO_2 emissions is summarized in Table 5.23. The reduction of the import of electricity is assumed to result in additional consumption of natural gas in CCGT power plants and consequently additional CO_2 emissions compared with an import level of 30 TWh.

5.1.9 Comparison with previous projection results

The projection results presented in this report are compared with the previous reports (NC6 and BR2) in figure 5.3 and 5.4. The main differences can be explained by the different sectoral assumptions as described in Chapter 5.1.5. In particular, the changes in the nuclear phase-out assumptions lead to a significant impact on the total greenhouse gas projections. There are no main differences in the non-ETS projection results.

Table 5.23: Sensitivity analysis for import of electricity in 2030

Import (TWh)	Additional consumption of natural gas (PJ)	Additional CO_2 emissions (kton CO_2)
20	74	4 160
10	152	8 533
5	191	10 728

Figure 5.3: Comparison of total GHG emissions excluding LULUCF (CRF inventory/WEM projections in this report versus WEM and WAM projections in NC6 and BR2)

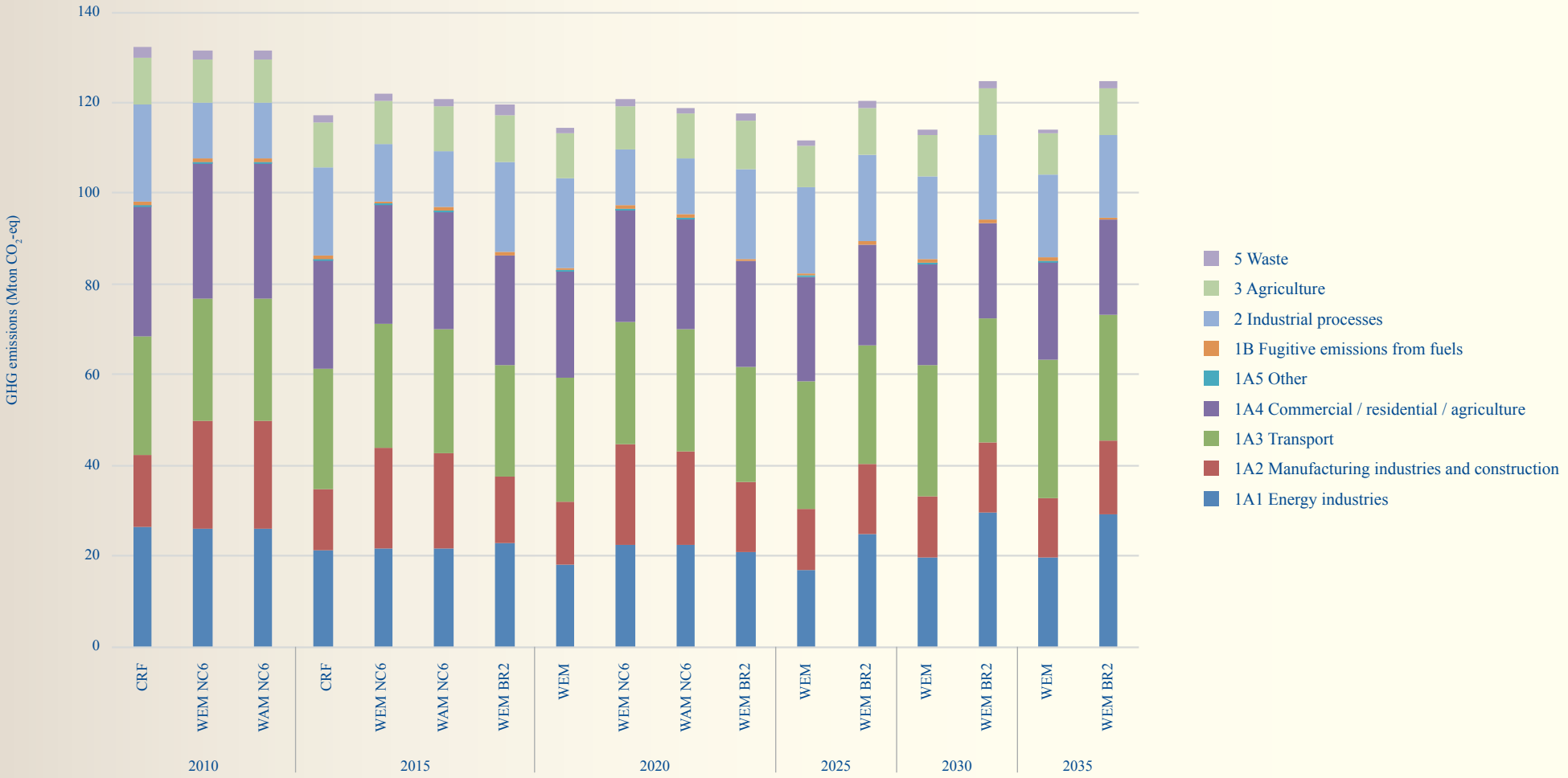
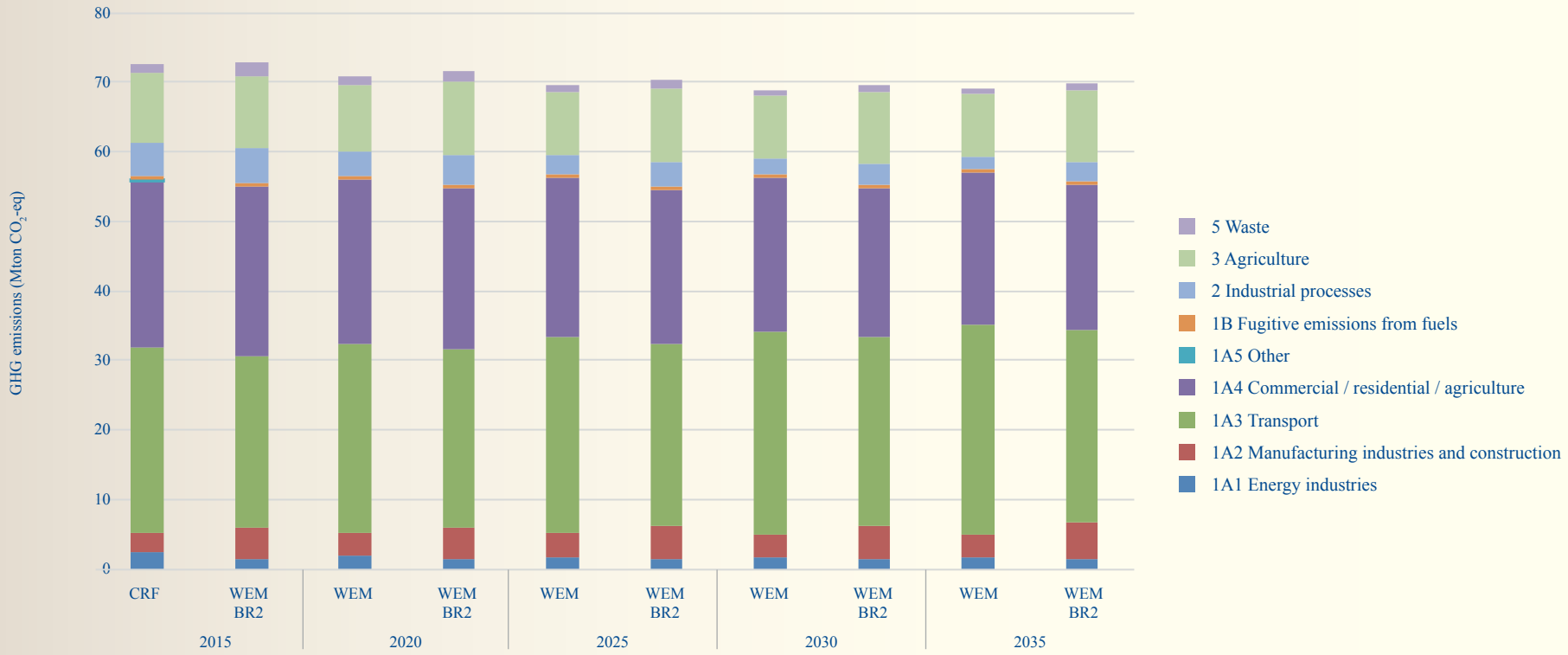


Figure 5.4: Comparison of non-ETS GHG emissions excluding LULUCF (CRF inventory/ WEM projections in this report versus WEM projections in BR2)



5.1.10 Conclusion

Overall emission levels

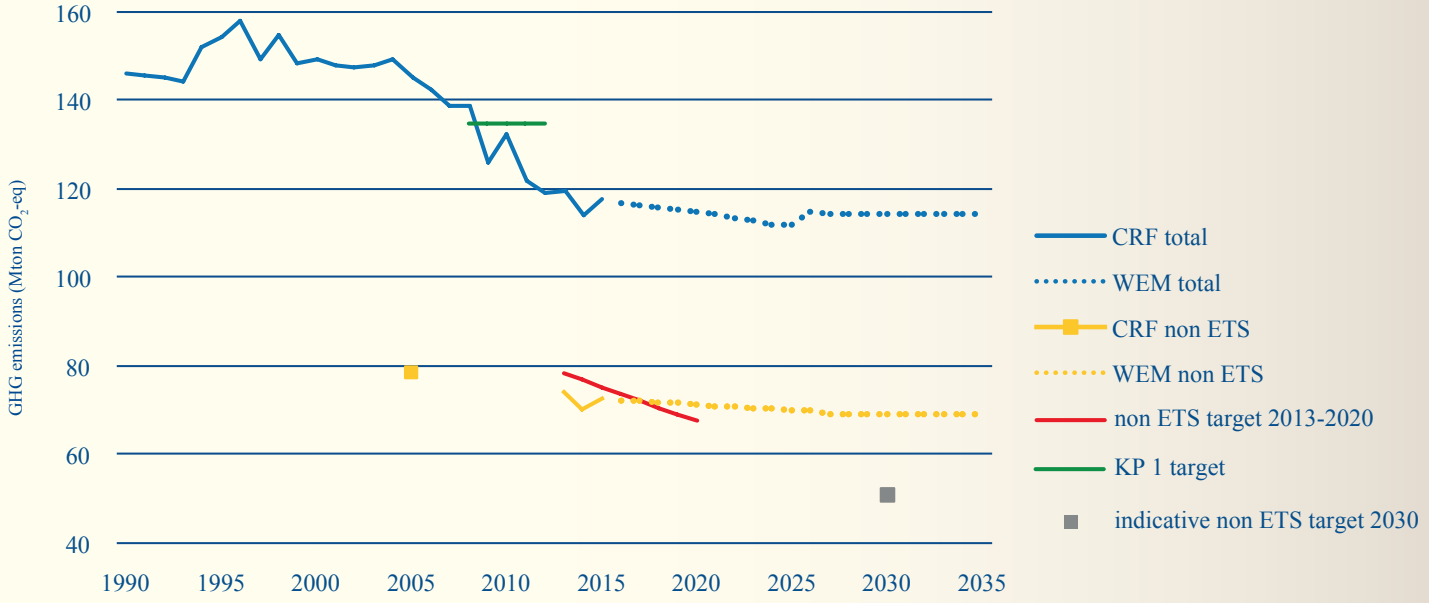
There is a clear decrease between 1996 and 2015 in the total greenhouse gas emissions in the inventory (Figure 5.5). However, the total emissions in the WEM scenario remain more or less stable at 114 Mton CO_2-eq in the period 2015-2035. These projections do not include emissions nor removals from LULUCF.

Projections with the macro-economic model suggest a decrease in emissions from 2014 to 2030 from 114 Mton CO_2-eq to 109 Mton CO_2-eq.

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

The EU Commission proposal[8] for the Effort Sharing Regulation, establishing binding annual greenhouse gas emission reductions by EU Member States from 2021 to 2030, mentions a target of -35 % in 2030 compared to 2005 for Belgium.

Figure 5.5: GHG emissions excluding LULUCF



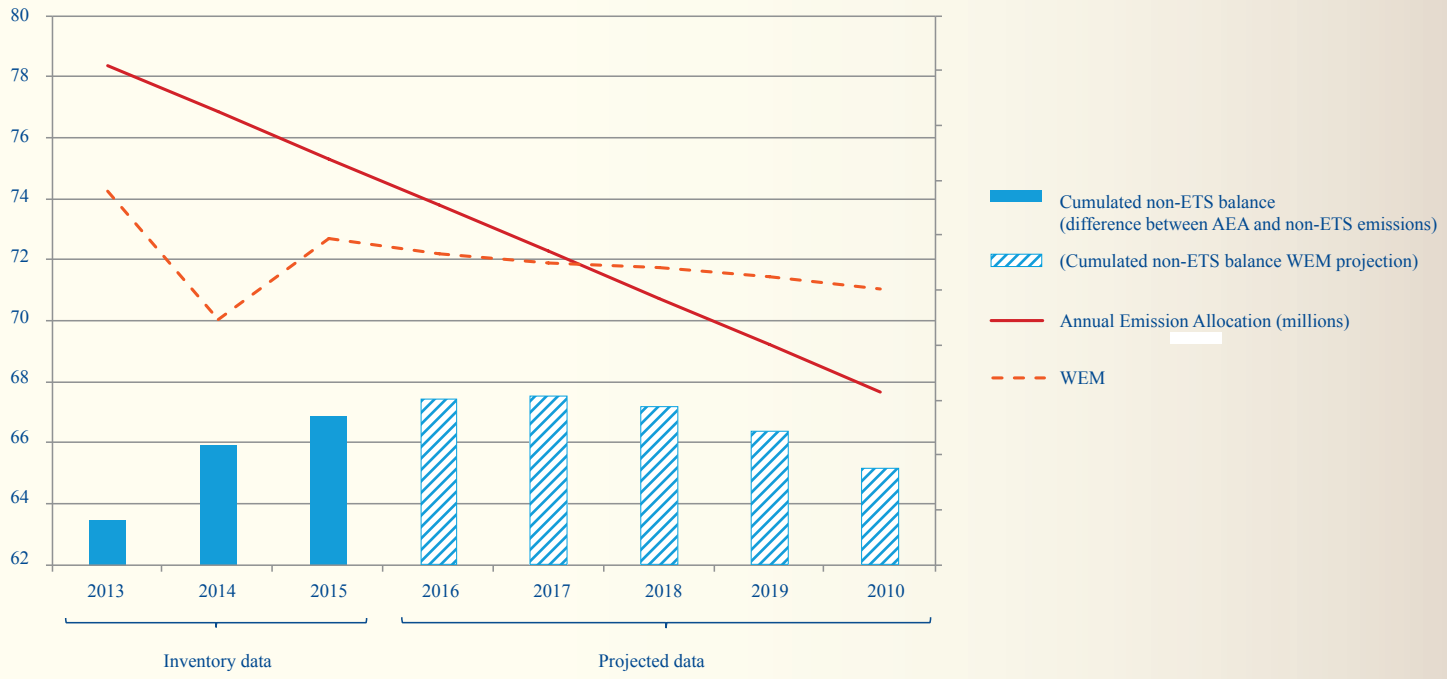
[8] COM (2016) 482 final – Proposal for a Regulation of the European Parliament and of the Council on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 for a resilient Energy Union and to meet commitments under the Paris Agreement and amending Regulation No 525/2013 of the European Parliament and the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change.

Comparison with the Effort Sharing Decision Target (2020)

A greenhouse gas emission limit of -15% in 2020 compared to 2005 greenhouse gas emission levels has been fixed for Belgium in the Effort Sharing Decision (Decision No 406/2009/EC). This results in an emission reduction path for the non-ETS sectors in Belgium. The annual Emission Allocations as laid down in the decision adopted in the Climate Change Committee on October 17th, 2012, have been corrected to take into account the effect of the adjustments pursuant to Article 10 of the Effort Sharing Decision as laid down in the implementing decision of October 31st, 2013. The European Commission has recently proposed an amending Decision to revise Member States' annual emission allocations for the period from 2017 to 2020 in order to take into account the impact of the IPCC 2006 guidelines. This decision will have a limited impact on the annual emission allocations for Belgium.

An indicative comparison of the inventory data for the period 2013-2015 and the WEM projection scenario for the period 2016-2020 with the AEAs for the entire period 2013-2020 shows an annual AEA surplus in the period 2013-2017 and annual AEA shortage in the period 2018-2020 at the Belgian level (Figure 5.6). Cumulated in the period 2013-2020 this evaluation indicates a net surplus of about 8.9 million AEAs.

Figure 5.6: Comparison of the WEM projection scenario with the AEAs for the period 2013-2020 (in Mtons of CO_2-equivalents). The blue bars are to be read on the right axis and provide information on the cumulated non-ETS balance



5.2 Assessment of aggregated effects of policies and measures

According to the UNFCCC reporting guidelines the total effect of policies and measures can be calculated as the difference between the "with measures" and the "without measures" scenarios, or as an aggregation of the individual effect of each significant policy and measure.

Belgium did not establish a "without measures" scenario since its climate policy is in place for many years now and it has become difficult to assess the way energy use and greenhouse gas emissions would have evolved without this policy.

Chapter 5 of this communication indicates the reduction effect of (a combination of) some existing policies and measures, for which such an effect could be estimated. Those impacts were calculated using a bottom-up approach. Although this analysis paid attention to the possible interlinkages between the different measures, double counting and overlap are still possible while the effect of several other measures could not be estimated.

Moreover, potential emission reductions represented by these measures, are estimated with respect to a reference situation which is not evaluated (the so called "scenario without measures"). The aggregated reduction effect should therefore be interpreted with care. In Chapter 4, it is estimated around 36.70 Mtonnes CO_2-eq in 2020, 43.76 CO_2-eq in 2025 and 46.75 Mtonnes CO_2-eq in 2030.

Those emission reduction potentials are mostly due to the implementation of existing measures.

Indeed, as already mentioned in Chapter 4, Belgium is currently in a transitional position as several authorities are still in the process of establishing their climate policy towards 2030. Many new ideas are under discussion, but cannot yet be considered as "planned" as long as they have not been submitted to the respective Governments. Therefore, Belgium is not yet able to report projections with additional measures in the NC7.

5.3 Supplementarity relating to mechanisms under article 6, 12 and 17, of the kyoto protocol

In general, in the EU, the use of flexible mechanisms can take place on the one hand by operators in the EU ETS, on the other hand by governments for the achievement of ESD targets.

A limited number of international credits may be used to achieve the targets:

- In the ETS, the use of international credits is capped (up to 50 % of the reduction required from EU ETS sectors by 2020). Quality standards also apply to the use of international credits in the EU ETS, including a ban on credits from LULUCF projects and certain industrial gas projects.
- In the ESD sectors, the annual use of international credits is limited to up to 3 % of each Member State's ESD emissions in 2005, with a limited number of Member States (including Belgium) being permitted to use an additional 1 % from projects in Least Developed Countries (LDCs) or Small Island Developing States (SIDS), subject to conditions.

5.3.1 Regarding the ETS

Since 2013, it is no longer possible to track the use of flexible mechanisms in the EU ETS directly via information on EUTL public website because CERs and ERUs are no longer surrendered directly but are exchanged into EUAs. These exchanges will become public on installation level after three years, with the first information reflecting the use in 2013 available in 2016. For information on the use of flexible mechanisms in the ETS, please refer to the 2nd and 3rd BR of the European Union.

5.3.2 Regarding the ESD

There is an annual limit of 3 % for the use of project-based credits for each MS. This amounts to approximately 750 Mt of international credits that can be used during the period from 2013 to 2020 in the ESD.

For Belgium, the amount of credits that can be used between 2013 and 2020 is 2.51 Million CERs and ERUs per year. If these are not used in any specific year, the unused part for that year can be transferred to other Member States or be banked for own use until 2020.

In addition to this limit of 3%, some MS fulfil additional criteria as laid down in ESD[9] Article 5(5)MS. Belgium (together with Austria, Cyprus, Denmark, Finland, Ireland, Italy, Luxembourg, Portugal, Slovenia, Spain and Sweden) fulfils these criteria and therefore, an additional use of credits is possible from projects in Least Developed Countries (LDCs) and Small Island Developing States (SIDS) up to an additional 1% of Belgium's verified emissions in 2005. For Belgium, the yearly additional amount of credits that can be used is 0.84 Million CERs and ERUs from LDC and SIDS. These credits are not bankable nor transferable.

At the moment, the use of flexible mechanisms under the ESD can be quantified for 2013 and estimated for 2014 (see Table 5.24), as the compliance assessment for 2013 (the first year under the ESD) took place in May 2017, and for 2014, it will take place by the end of 2017.

Regarding the first commitment period (CP1) of the Kyoto Protocol (2008-2012):

The final compilation and accounting report for Belgium during CP1 are compiled in document FCCC/KP/CMP/2016/CAR/BEL. We have used those numbers in Table 5.24, in order to show that Belgium reduced its emissions by 14% during CP1, while its objective was -7.5%. Belgium has achieved this reduction primarily through domestic effort, and has made use of the flexible mechanisms under Article 6, 12 and 17 of the KP only to 'supplement' its domestic effort.

Regarding the post 2012 period:

For the ETS: please refer to the 2nd and 3rd BR of the European Union.

For the ESD:

– For 2013: 74 264 633 AEAs were retired, and zero international credits.
– For 2014: our emissions amounted to 70 054 910 tCO_2eq, and we will retire a similar amount of AEA and no international credits. However, this is not yet officially confirmed, as the compliance cycle has not started yet.

For the coming years, Belgium does not foresee to use international credits. However, if needed, some credits were already carried over from CP1 to CP2 or are available for carry-over, as showed in Table 5.24. ■

Table 5.24: Supplementarity during CP1 (2008 – 2012): use of flexible mechanisms

Base year GHG emissions	$t\ CO_2e$	145 728 763
Quantified emission reduction commitment for CP1 (% of base year level)	%	92.5
Assigned Amount established in accordance with Article 3.7 and 3.8 of the KP	$t\ CO_2e$	673 995 528
Total GHG emissions in CP1 (2008 – 2012)	$t\ CO_2e$	626 308 776
Quantity of KP units in the retirement account *AAUs* *Of which: AAUs acquired from other Parties* *CERs* *ERUs* *RMUs* *tCERs* *lCERs*	units	 590 701 837 3 934 828 26 162 846 9 451 546 0 0 0
Total use of flexible mechanisms under Article 6, 12 and 17	units	39 553 154
Total quantity of units already carried-over to CP2 *ERUs* *CERs* Total quantity of units still available for carry-over to CP2 *AAUs*	units	 3 267 881 16 822 907 1 706 252

[9] Decision No 406/2009/EC.

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6. Vulnerability assessment, climate change impacts and adaptation measures

6.1. Introduction

6.1.1. European context

The EU strategy on adaptation to climate change was adopted by the European Commission on 16 April 2013. The overall aim of the EU Adaptation Strategy is to contribute to a more climate resilient Europe.

To achieve this, the strategy focuses on 3 key aspects:

- promoting initiatives at Member State level;
- better-informed decision-making;
- taking better account of adaptation in the most vulnerable sectors ('climate proofing').

The EU strategy on adaptation foresees that, in 2017, the European Commission will report to the European Parliament and the Council on the state of implementation of the EU Adaptation Strategy, and propose its review, if needed. This evaluation is ongoing.

6.1.2. National context

In 2010, Belgium adopted its National Adaptation Strategy [6]. The strategy describes the main climate change impacts, the existing adaptation responses, a roadmap to a future National Adaptation Plan (NAP) [7] and some policy guidelines for an adapted future.

Since its 6th National Communication, Belgium has made significant progress in the field of adaptation.

The regional and the federal governments have all adopted adaptation plans, each in their own area of competence:

- On 28 June 2013, Flanders adopted the Flemish Climate Policy Plan 2013-2020 [1], including a section on adaptation known as the Flemish Adaptation Plan (VAP). The primary goals are understanding the Flemish vulnerability to climate change and improving Flanders' ability to defend against the effects of climate change. The concurrent pursuit of these goals can be described as the "climate reflex". The 11 involved Flemish governmental departments maintain responsibility for the actions in their policy domain and they will bear the cost of these actions using their usual financial resources. In 2015 Flanders developed a first progress report 2013 – 2015 on climate change, including a section on adaptation.
- On 2 June 2016, the Brussels-Capital Region adopted its Integrated Air-Climate-Energy Plan which includes a section on adaptation. Its legal basis is the Brussels Air-Climate-Energy Code (known as COBRACE) of 2 May 2013. Other thematic plans with adaptation

measures are the regional water management plan (adopted on 26 January 2017 for the period 2016-2021) which completely integrates the theme flood, the "forêt de Soignes" management plan (2003) and its Nature Plan (2016).

– In January 2014 the Walloon government adopted its "Climate Decree" giving a legal framework to climate policy in Wallonia. The main implementation instrument is the "Air-Climate-Energy Plan" which contains a section on adaptation. This section summarises the impacts & vulnerability assessments and detailed adaptation actions in several sectors. Water management, forestry guidelines and agricultural advice are some examples of these actions. After a public consultation, the final version was adopted in April 2016.
– On 28 October 2016, the federal government adopted the Federal Contribution to the National Adaptation Plan (available in Fr and Nl [11] which identifies federal adaptation actions in crisis management and transport. The contribution was submitted previously to a public survey in 2014.

The draft National Adaptation Plan was submitted to the Federal Council for Sustainable Development and regional advisory bodies (CERBC, CESRBC, CWEDD, CESW, Minaraad and SERV) in December 2016. Their joint opinion on the draft plan was published in 13 February 2017. The National Adaptation plan (2017-2020) was adopted by the National Climate Commission in April 2017. It identifies specific adaptation measures that need to be taken at national level in order to strengthen cooperation and develop synergies between the different entities on adaptation. The Plan addresses 6 sectors and transversal issues: biodiversity, crisis management, energy, health, research and international cooperation.

Adaptation Plans were developed taking into account the EU guidelines on developing adaptation strategies, which are a component of the EU strategy on adaptation to climate change. The EU guidelines refers to, inter alia, the UNEP Handbook on Methods for Climate Change Impacts Assessment and Adaptation Strategies and the IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptation. The adaptation studies and plans were written in the spirit of the IPCC Technical Guidelines even if they do not explicitly refer to it.

6.2. Forecast impacts of climate change in Belgium

6.2.1. Observed past trends

In 2015 the VMM published the 'MIRA Climate Report 2015: About observed and future climate changes in Flanders and Belgium' [2]. The indicators from the report are regularly updated on their website [3]. An overview of the main conclusions is provided below, supported by a few figures [2; 3].

6.2.1.1. Temperature

Belgium (Uccle) is now 2.4 °C warmer than in the pre-industrial period. 'For more information on observed temperature trend, we refer to Chapter 2.4 'climate profile' ('national circumstances').

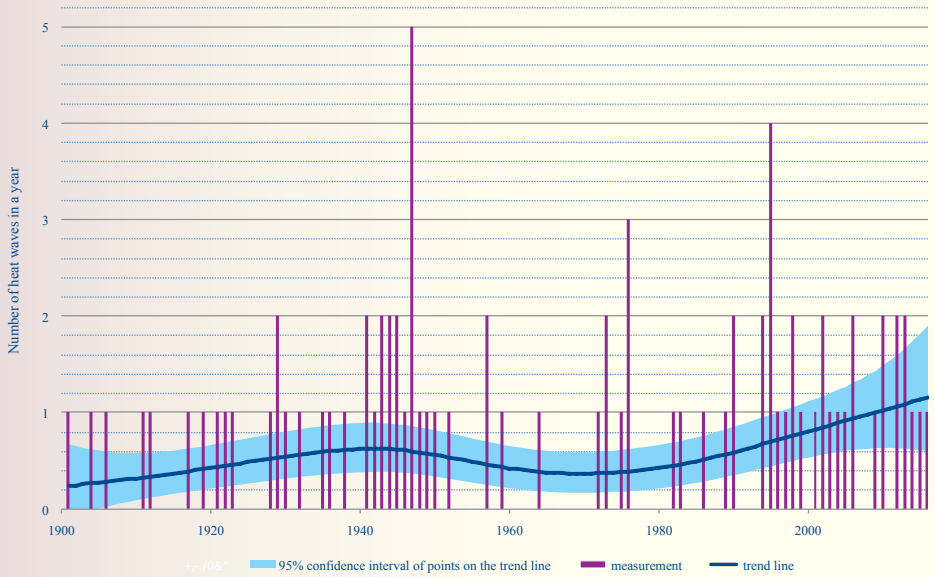
Heat waves and other temperature extremes

The vulnerability of people and nature to climate change is determined not only by changing annual and seasonal averages, but also, and even more so, by changing extremes. Moreover, extreme temperatures also increase exposure to various harmful substances such as tropospheric ozone and particulate matter. When we look at the occurrence of the number of days with (extremely) high or low temperatures, a significant, linearly increasing trend is found only for the number of tropical days ($T_{max} \geq 30$ °C). For the measuring point in Uccle we count, per 14 years, one extra tropical day in a year. The equally increasing trend for the number of summer days ($T_{max} \geq 25$ °C) in a year is not statistically significant. The figures for the number of frost days ($T_{min} < 0$ °C) and ice days ($T_{max} < 0$ °C) indicate a downward trend, but this trend too does not appear to be significant.

The most harmful climate effects in Europe are expected to come from the increased frequency and intensity of extreme events such as heat waves. In Belgium the number of heat waves shows great variability between years (Figure 6.1). A trend analysis produces a wavy pattern with an increase that has been sustained since the 1970s. In 2016, the number of heat waves was significantly higher than in the beginning of the 20th century. The frequency of heat waves has increased from on average one every three years to one per year.

In addition to the number of heat waves, it is important to consider the length (number of days during heat waves in a year), the weight (the extent to which the temperature exceeds 25 °C) and the intensity (ratio between weight and length) of the heat waves. An analysis for the period 1901-2016 also reveals a wavy pattern for these three parameters, with an

Figure 6.1: Number of heat waves per year (Uccle, 1901-2016)



A 'heat wave' is defined as a period of minimum five consecutive days with a maximum temperature of at least 25°C, where the maximum temperature is greater than or equal to 30°C for at least three days. This indicator has been built up on the basis of measurements in an open thermometer shelter. The closed shelter (which is currently the RMI reference) has only been used in Uccle since 1968. Source: MIRA based on RMI (www.milieurapport.be) [3]

ascending trend line since the 1970s. In 2016, all three trendlines are significantly above the values. For instance the length of heatwaves evolved from an average of 5 days in a year between 1901-1930 to an average of 11 days in a year for the period of 1988-2016.

Impact of urbanisation

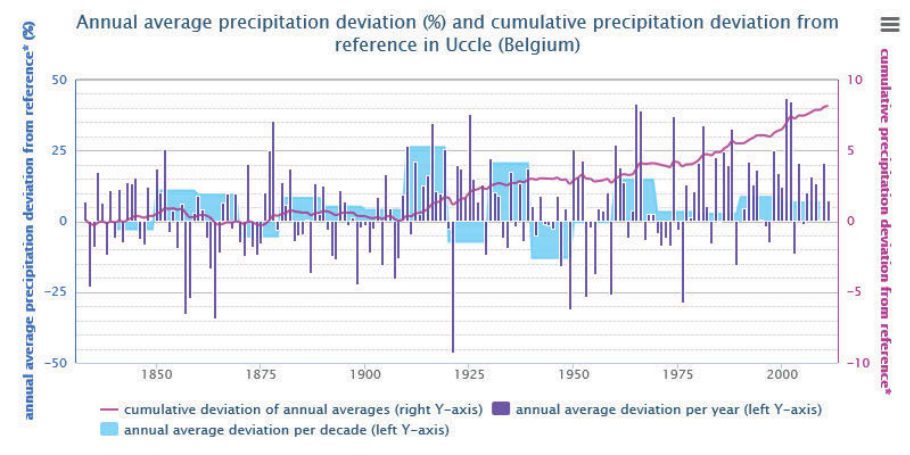
Urbanisation of the landscape causes a change in the local wind climate and involves the use of materials that better capture the heat, such as concrete and asphalt. This leads, especially at night, to the creation of heat islands, characterized by the fact that the city cools off more slowly than the surrounding countryside. On average, this difference amounts to a few degrees, but also days with peaks of up to 7 to 8 °C and more are recorded. This so-called urban heat island (UHI) effect is further accentuated during heat waves under the influence of atmospheric conditions such as a cloudless sky and low wind speeds that often accompany heat waves. This leads to additional mortality, especially among the elderly and children. Furthermore, the urban heat island phenomenon also influences energy use (increase due, among other things, to the use of air conditioning), and promotes algae growth in surface water. In the winter, by contrast, the mortality in cities is lower due to reduced exposure to cold temperatures.

Analyses by the RMI, KU Leuven and VITO show that the temperature increase in Uccle may, to some extent, also have been caused by the so-called heat island effect. Thus, a quarter of the annual average temperature increase in summer, recorded in Uccle between 1960 and 1999, is attributed to the intensification of the urban effect in the Brussels Capital Region (RMI, 2015) [19].

The urban heat island effect can be translated into figures by means of the indicator 'heat wave degree days' (for more details, we refer to the MIRA report). This indicator provides a composite picture of the total duration and the weight of heat waves in a year. The indicator is calculated for both an urban and a nearby rural location to highlight the urban effect.

The indicator can as yet only be used for Antwerp. No permanent datasets are yet available for other central-urban and surrounding rural locations. Moreover, the dataset for Antwerp only begins in 2012 and it is therefore too early to draw any conclusions about the evolution in time of the urban heat island. Using a regional climate model (with a resolution of 2.8 km) with a specific urban module, it was possible to retroactively reconstruct the indicator rather accurately for longer periods (and several cities in Flanders). Apparently there is a great variability in time for the number of heat wave degree days in the urban areas, with peaks in the years 2003 and 2006. Furthermore, extrapolation of historical years with a regional climate model shows that the number of heat wave days is strongly influenced by the size of the city.

Figure 6.2: Precipitation per year and per decade (Uccle, 1833-2015)



Source: MIRA based on RMI (www.milieurapport.be) [3]

6.2.1.2. Precipitation and evaporation

Annual precipitation is increasing

Since the beginning of the observations in Uccle, 2001 and 2002 have been the absolute record years with amounts of precipitation of 1 088.5 mm and 1 077.8 mm respectively. There are clearly increasingly more wet than dry years in our country. Figure 6.2 maps the deviation of the annual amount of precipitation from the average of 758 mm/year in the reference period 1850-1899. The trend towards wetter years is particularly apparent from the line representing the cumulated deviation. In the 19th century this line constantly hovered around zero. Since the beginning of the 20th century, however, a clear increase is seen, which becomes even more pronounced from the 1970s on. For the first time since the beginning of the measurements, we also see six consecutive decades with an annual precipitation that exceeds that of the reference period.

The amount of precipitation shows very high variability from year to year. Moreover, there have been longer periods with more precipitation, e.g. around 1920, 1960 and 2000. But statistical analysis of the whole time series can assist in detecting a long-term trend. The analysis shows that our country (measuring point Uccle) witnesses a slow but significant increase in the annual precipitation. This increase continues by 0.5 mm/year or half a cm per decade. The trend line shows that the annual precipitation is currently around 91 mm higher than at the beginning of the measurements.

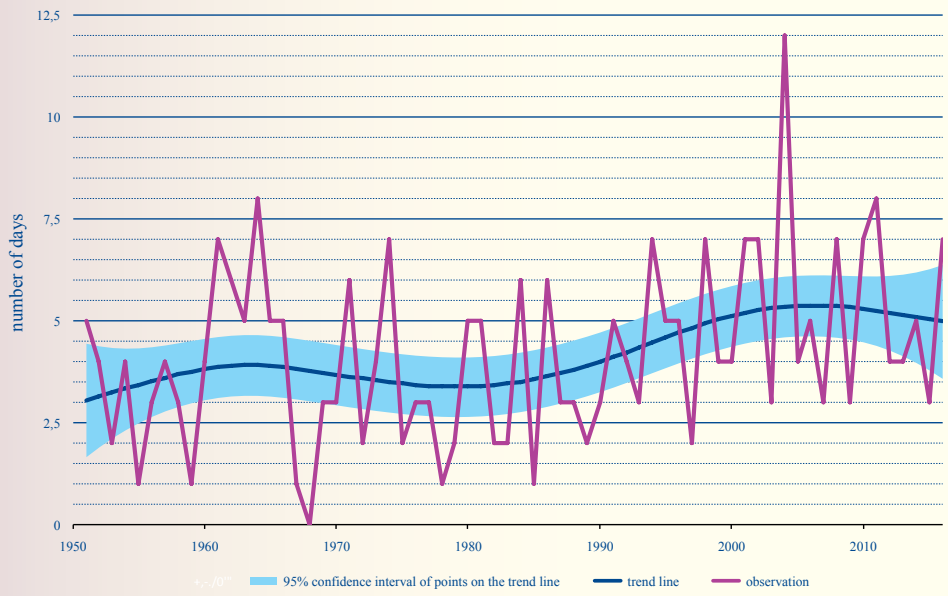
The patterns in annual average precipitation within Belgium for the reference period of the present climate (1981-2010) show that hardly any differences are recorded within Flanders. More towards the south of the country, however, the differences can increase significantly: the values evolve from 740 mm/year in the north of Haspengouw (the Sint-Truiden region) to more than 1 400 mm/year on the High Fens, or a doubling between the driest and wettest locations. The monthly amounts of precipitation in the coastal region are generally among the lowest in the country. Only during autumn, the amount of precipitation at the coast is higher than in Low and Middle Belgium due to the higher seawater temperature.

Wetter winters

Changes in precipitation not only manifest themselves by changing annual totals. Even more important for the potential impact are the shifts per season. When we look at the complete dataset 1833-2016, a significant increase in the amount of precipitation in Belgium (Uccle) is only noticeable during the winter. The amount of precipitation in the other seasons does not change or changes very little.

Belgium (Uccle) has on average 201 days with measurable precipitation per year (at least 0.1 mm/day). Extreme years were 1974 and 1977 with 266 and 265 precipitation days respectively. The analysis

Figure 6.3: Number of days of heavy precipitation (≥ 20.0 mm per day) (Uccle, 1951-2016)



Source: MIRA based on RMI (www.milieurapport.be) [3]

of the precipitation data over the complete period 1833-2016 shows that the number of days with measurable precipitation in a year increased significantly. Moreover this increase only occurs in winter. A specific analysis for precipitation in the form of snow revealed that snow has clearly become less frequent in Belgium. This is closely related to the rise in temperatures.

Extreme precipitation and droughts

In addition to the shift or change in annual and seasonal averages, it is important to gain insight into changes in the occurrence and the nature of periods of extreme precipitation. Periods with extreme amounts of precipitation may in fact lead to floods, whereas long dry periods may lead to desiccation of ecosystems and depletion of water reserves. For Belgium (Uccle), the time series of the number of days of heavy precipitation (at least 20 mm/day) shows a clear trend: especially between the middle of the 1980s and the beginning of the 2000s the number of days of heavy precipitation increased significantly. In the meantime, a year has already 5 days of heavy precipitation, compared to only 3 days in the beginning of the 1950s. The record year was 2004 with twelve days of heavy precipitation (Figure 6.3). Heavy rainfall occurs mostly in summer because of heavy thunderstorms that occur in a space of a few hours.

Changes in extreme precipitation can also be detected by measuring, per year, the maximum precipitation measured on one day or over a consecutive period of five, ten or fifteen days. The analysis for the dataset 1880-2016 shows that the trend lines are slowly going up. Due to the greater variance over a short period, this increase is not significant for a one-day period, but for consecutive periods of five, ten and fifteen days the maximum amount of precipitation within those periods appears to be significantly higher in 2016 than in 1880, respectively amounting to +10 mm, +18 mm and +25 mm.

Daily data for Potential Evapotranspiration have been recorded for Uccle since 1901. Between the beginning of the measurements and the end of the 1970s, the dataset of the annual totals does not show a clear trend. Since the beginning of the 1980s, however, the trend line for the annual PET has significantly increased. In 2015, the trend line was 144 mm higher than in 1901, which corresponds to an increase of one quarter. As temperature is a determining factor for evaporation, it is no coincidence that the trend line strongly resembles that of the annual average temperature. The PET in the growth season (from April to September) shows an analogous trend line with a significant increase.

The precipitation deficit is the difference between precipitation and potential evapotranspiration. The precipitation deficit can therefore be used as an approximation of drought stress in plants. For Belgium the trend line for the maximum increase in the cumulative precipitation deficit over 30 days increases slowly, espe-

cially after 1980, but the current increase is not statistically significant. The results for the analysis of the maximum cumulative precipitation deficit over 90 days, the annual cumulative precipitation deficit at the end of the growth season (at the end of the growing season on September 30th) and the annual maximum of the cumulative precipitation deficit are comparable: the trend lines increase slightly but they are not statistically significant. This is explained by the fact that the significant increase in potential evapotranspiration is partly offset by a slight (not significant) increase in precipitation during the growing season. In addition, the large variation in the indicators for precipitation deficit complicates the detection of trends.

Periods of drought also come under the heading of 'extreme precipitation'. The maximum number of consecutive dry days (≤ 0.5 mm precipitation) (during the growing season) in a year shows no significant trend for the measuring point in Uccle over the period 1880-2016. This indicates that periods of drought have not become more intense since the end of the 19th century. The record years are 1893 and 2007, having periods of drought of 44 and 37 days respectively.

6.2.1.3. Wind

In Uccle, the average wind speed remained relatively stable until around 1960, after which it decreased continuously. Today, the annual average wind speed is approximately 15% lower. The impact of changing vegetation around Uccle is not known, but also at the measuring points in Zaventem and Saint-Hubert – where no significant changes in the surroundings have occurred since the 1960s – the average wind speed appears to have fallen by 10%. This decrease in wind speed is recorded in all seasons, except in winter, the season in which the highest wind speeds generally occur (RMI, 2015) [19].

No clear trend is apparent for the occurrence of storm days - with maximum wind gusts over 70 km/h - nor for the highest measured wind speeds. The intensity of storms has therefore not increased in Belgium over the last decades (RMI, 2015) [19].

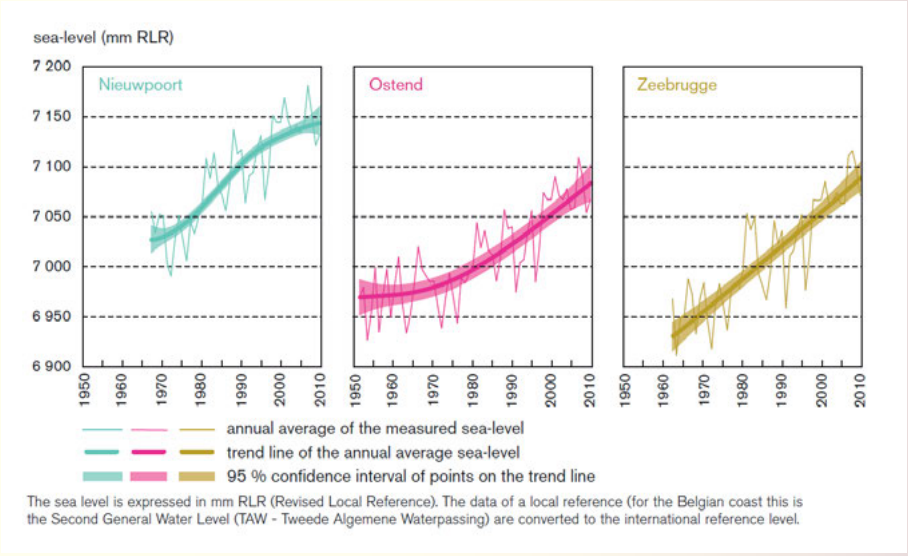
6.2.1.4. Sea Level

The statistical analysis of the values measured at the Belgian coast shows that the annual average sea level in 2015 is significantly higher than at the beginning of the time series. The longest time series available for the Belgian Coast (in Ostend) shows a trend line that lies 112 mm higher in 2015 than in 1951. Also the 2 other measurement points show a significant trend: Nieuwpoort + 84 mm between 1967 and 2015, Zeebrugge +54 mm between 1979 and 2015 (Figure 6.4).

Further analysis for Ostend shows an initial rise of mean sea level of 1 mm/year.

Since the mid-1960s, this rise has steadily increased to 2.7 mm/year in the mid 90s. In recent years, the increase has continued, but the rate has fallen to 1.3 mm/year. The speed at which the sea level rises thus appears to be subject to multiannual fluctuations, but the sea level has risen undoubtedly. In addition to the influence of climate change, the sea level (both the average sea level and the high tide) is also subject to a natural fluctuation with an interval of 18.61 years. As a result of variation of the angle between the earth, the sun and the moon, the sea level rises far more in some periods than in others.

Figure 6.4: Rising sea level at the Belgian coast (Nieuwpoort, Ostend, Zeebrugge 1951-2015)



The sea level is expressed in mm RLR (Revised Local Reference). The data of a local reference (for the Belgian coast this is the Second General Water Level (TAW - Tweede Algemene Waterpassing) are converted to the international reference level.

Source: MIRA based on PSMSL and Agency for Agentschap Maritieme Dienstverlening [3] (www.milieurapport.be)

A study examined the extreme high tides in Ostend and the contribution of individual astronomical and storm-building components, trends and long-term fluctuations in it. This showed that, in addition to the increase in the annual average sea level, the storm plan did not show a separate or additional rising trend [20].

A study by the European Environment Agency indicates that within Europe, Belgium, after the Netherlands, is the most vulnerable to flooding as a result of the rising sea level: in Flanders, 15% of the surface area is less than 5 metres above the average sea level. Moreover, the Belgian coastline appears to be the most built-up in Europe: in 2000, over 30% of the 10 km coastal strip was built up and as much as nearly 50% of the strip up to 1 km from the coastline [18]. In the Province of West Flanders, 33% of the population live in low-lying polder areas which are sensitive to flooding by the sea.

6.2.1.5. Seawater temperature, salinity, wave height and wind speed at sea

In all the sub-areas of the North Sea (not only the Belgian part), the seawater temperature is rising. Moreover, a natural variability appears to occur with a period of seven to eight years. In the area closest to the Belgian coast, the increase is approximately 0.034 °C per year or 3.4 °C per century.

No datasets are currently available that allow a long-term analysis of a climate influence on the salinity of our sea water.

Regarding the wave height, the historical dataset in and near the Belgian part of the North Sea only suggests a natural variability with a period of approximately seven years. There is also a seasonal cycle: on average, there are higher waves in winter and lower waves in the summer months. A clear climate trend could not be demonstrated in the historical wave height and wind speed datasets.

6.2.1.6. Natural disasters

Since 1992 the EM-DAT database has recorded the following disasters with victims in Belgium: seven episodes of extreme temperature, twelve floods and thirteen storms. The 2002 storms and floods were the most devastating, with 23.3 victims per 100 000 inhabitants. In comparison with the EU 28, Belgium has far fewer victims of natural disasters per 100 000 inhabitants.

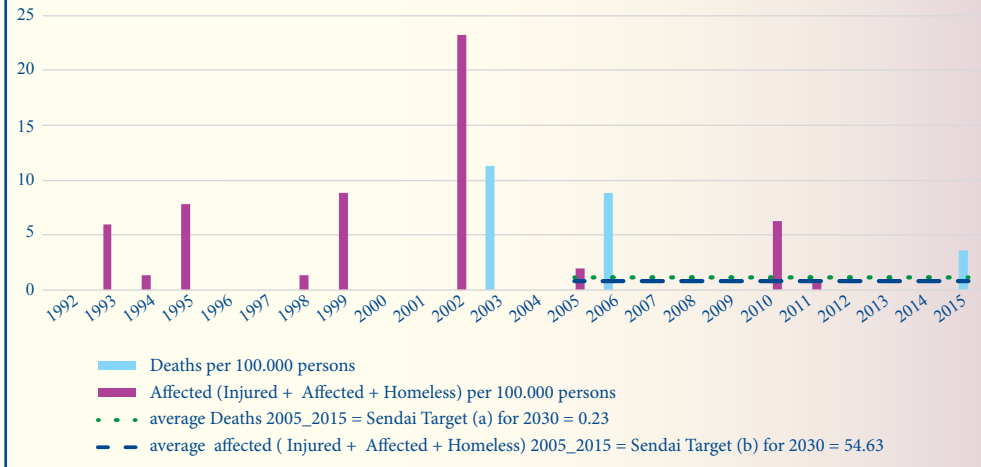
The evolution of the number of victims (deaths and affected persons) of natural disasters in Belgium shows a highly variable trend, mainly due to the erratic nature of natural disasters [16, 17] (cf. Figure 6.5).

6.2.2. Climate projections

Since the previous national communication, new climatic projections have been built for the Belgian territory in the framework of the Belgian CORDEX.be project which aims to combine regional downscaling expertise in Belgium [12]. This project, funded by BELSPO (Belgian Science policy), started in 2015 (and ended in September 2017) brought together the different Belgian climate modelling groups. The main objectives of the CORDEX.be project are:

1. to contribute to the international CORDEX project ("COordinated Regional Climate Downscaling Experiment") by performing regional climate simulations over Europe
2. to provide a set of high-resolution (H-Res) climate simulations over Belgium (H-Res models run at resolutions of 4 km)
3. to present an overview of the ongoing climate modelling activities in Belgium
4. to provide coherent climate information for Belgium targeted to end-users,

Figure 6.5: Evolution of the number of victims (death and affected persons) due to natural disasters in Belgium (number of victims by 100 000 persons)



Source: Federal Planning Bureau, calculations based on Guha-SapirD., Below R., HoyoisPh. (2017), EM-DAT: The CRED/OFDA International Disaster Database, http://www.emdat.be/ (consulted on 09/05/2017) Université Catholique de Louvain, Brussels, Belgium and Eurostat (2017) Average population (consulted on 09/05/2017) [16, 17]

backed by: (i) an unified framework for the high resolution climate runs and (ii) uncertainty estimations on the climate change signal;

5. to present a climate-impact report for stakeholders and the general public that highlights the most important project results.

Climate simulations performed in the context of the CORDEX.be project are based on greenhouse gas concentration trajectories or RCPs (Representative Concentration Pathways) adopted by the IPCC in their latest Assessment Report. The status of the CORDEX.be model simulations on March 2017 is given in Figure 6.6.

Results are shown for greenhouse gas scenario RCP8.5, also called the business-as-usual scenario as it assumes little or no mitigation measures are taken. High resolution climate change maps for the period 2070-2100 are shown for temperature and precipitation.

6.2.3. Extremes

Detailed heat-stress projections for Belgium are constructed combining the CORDEX.be convection-permitting climate model simulations with statistical analysis of a set of general circulation models, both developed in the CORDEX.be project. The assessment shows that the heat-stress increase for the mid-21st century is twice as large in cities compared to their surrounding rural areas. The exacerbation is driven by the urban heat island itself, its temporal coincidence with heatwaves and urban expansion. Cities experience a heat-stress multiplication by a factor 1.4 and 15 depending on the scenario. Remarkably, the future heat-stress surpasses everywhere the urban hot spots of today [13, 14].

Figure 6.6: Status of the climate simulations that were performed (✓) or ongoing (O) by the three regional climate models on March 2017

ALARO-0 over Europe (12.5 & 50 km resolution)

	Evaluation	Historical	RCP 2.6	RCP 4.5	RCP 8.5
1950-1976	✓ (1957-1979)	✓	–	–	–
1976-2005	✓	✓	–	–	–
2005-2040	–	✓ (2005-2015)	✓	✓	✓
2040-2070	–	–	✓	✓	✓
2070-2100	–	–	✓	✓	✓

ALARO-0 over Europe (4 km resolution)

	Evaluation	Historical	RCP 2.6	RCP 4.5	RCP 8.5
1950-1976	O (1958-1979)	O	–	–	–
1979-2010	✓	–	–	–	–
1976-2005	–	✓	–	–	–
2005-204	–	O (2005-2015)	O	✓	✓
2040-2070	–	–	✓	O	O
2070-2100	–	–	O	O	✓

COSMO-CLM (KU Leuven) over Europe (12.5 km)

	Evaluation	Historical	RCP 8.5
1979-2014	✓	–	–
1976-2005	–	✓	–
2070-2100	–	–	✓

COSMO-CLM (KU Leuven) over Europe (2.8 km)

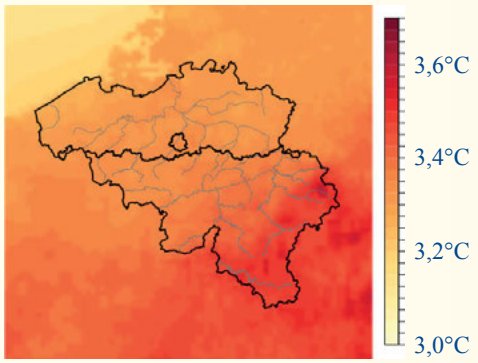
	Evaluation	Evaluation	Evaluation	Historical	RCP 8.5
	urbanization = year 2000	using a vegetation land-use scenario	urbanization = year 2000		
1979-2014	✓	✓	✓	–	–
1976-2005	–	–	–	✓	–
2071-2100	–	–	–	–	✓

MAR over Belgium (5 km)

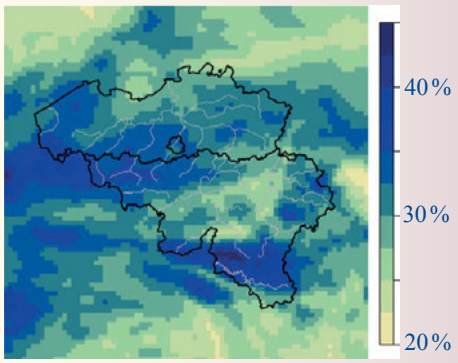
	Evaluation	Evaluation	Historical	RCP 8.5
	ECMWF- ERA40-ERA-Interim-ERA20C	NCEP/ NCAR-v1	NorESM1/ CanESM2	NorESM1/ CanESM2
1958-2014	✓	–	–	–
1948-2015	–	✓	–	–
1980-1999	–	–	✓	–
2080-2099	–	–	–	✓

Figure 6.7: Climate-change maps obtained using H-Res ALARO-0 with spatial resolution of 4 km. Figure (a) shows the projected temperature change while Figure (b) shows the relative change in winter precipitation. Climate change is considered here as the (relative) difference between the period 2070-2100 (following the scenario RCP 8.5) and the historical reference period 1976-2005

a) Temperature change (RCP85)



b) Relative precipitation change (RCP85)



General climate trends for Belgium based on different climate scenarios for Belgium over 100 years (CMIP5):

- **A hotter climate**: all the projections show an increase of temperature in all seasons (from +1 °C to +4.6 °C by 2100 for the mean monthly temperature in winter; from 1.1 °C to 7 °C in summer).
- **A reinforcement of the precipitation seasonality**: precipitations are expected to decrease in summer (up to -53 % for mean monthly precipitation by 2100) and increase in winter (up to 36 % by 2100). The decrease in summer is mainly due to the decreasing number of wet days.
- **More extreme events**: heavy rains in winter and heavy thunderstorms in summer are projected to be more frequent or more intense, just as the heat waves that are expected to be more frequent in summer.
- The changes in temperature and precipitation show minor **regional differences** within Belgium. For the densely populated cities, the absolute temperature values will be higher than on the country side due to the urban heat island effect. The number of hot days will increase more in the central area of Belgium. The number of extreme cold days will have the strongest decrease in the Ardennes. For precipitation, the winter precipitation amounts will increase stronger for the Belgian coast. There is moreover a slight north-south pattern: slightly stronger increase in winter precipitation in the northern areas of the country, slightly stronger decrease in summer precipitation in the southern areas.
- **A fall in the average summer precipitation, in combination with greater evaporation, will cause the lowest river flows to fall during dry summers between 20 and 70 % (mean of about 50 %) by the end of the 21st century.** As a result, the risks of a serious water shortage with implications for domestic, industrial and agricultural water supply, navigation, and water quality / ecology also increase.
- The sea level at the Belgian coast will further rise, most likely between 20 and 90 cm by 2100. Higher changes may occur as well, but with a lower likelihood.

6.3. Vulnerability assessment and climate-change adaptation measures

Impact, vulnerability and adaptation assessments have been funded and piloted at regional and federal level. These preliminary studies were the first step before starting the development of regional and federal adaptation plans.

Besides these trans-sectoral studies, several specific impact assessments have been also funded by Belgium in different sectors (coastal zones, forestry, agriculture...).

The economic impact of climate change is not yet fully known. Global models can be used to assess the costs of adaptation but cannot easily be translated to the local scale. Two first studies have tried to get more grasp on this issue: The first one ("AdaGLOBALE Kptatie aan klimaatverandering: Globale kosten en praktische voorbeelden" [21]) tried to assess the costs on local scale through an evaluation of 4 typical quarters. The second one aimed to answer the question "What would be the additional costs if today we had the 2050 climate?" (in other words, without any adaptation measures). The most considerable costs are met in the sectors of biodiversity, water management & infrastructures, and forestry. As quite some part of the costs are not yet known, it is difficult to have an overall view.

Most of the Belgian studies can be consulted on the Circle 2 ERA-net infobase and on the different Belgian websites (LNE, Brussels Environment, AwAC, BELSPO -SSD and BRAIN-, Climatechange.be). A brief description of the major impacts and vulnerabilities is given in Table 6.1 for various sectors impacted by climate change in Belgium (adapted from the different regional vulnerability studies mentioned above [4], [5], [9]).

In depth description of impacts and vulnerabilities and adaptation measures in water management, coastal management, biodiversity, agriculture, forestry, fishery, infrastructure, transport, industry and services, energy, tourism, health is available in the 6th National Communication. Updated information on implementation is provided in Table 6.2.

Table 6.1: Summary of the main impacts and their severity expected in Belgium (adapted from regional impact assessments studies). The top of the table gives an idea of the uncertainties by using different projections: according to the projections, the change in temperature will be more or less quick and extensive

Wet Projections		2030	2050	2085				
Mean Projections		2030	2050			2085		
Dry Projections				2030			2050	2085
Temperature rising (°C)	0,5	1	1,5	2	2,5	3	3,5	4
Agriculture	↗ in erosion risk due to heavy rain ↗ in loss of soils due to heavy rain Variability of crop production and breeding (↗ in the frequency of extreme events) ↗ pressure from diseases, parasites, weeds and invasions ↗ in water needs and risk of water stress ↗ in yields or production of certain crops Limiting factors (photoperiod, water, fertility) and reversal of the trend							
Coastal Areas	↗ risks of breaking of natural (mostly sand and dunes) coastal defences ↗ risks of breaking of man-made (dykes, wave-breakers, ...) coastal defences ↗ risks of higher storm-related flooding damage caused by changes to wind patterns anw wave height reduction of upper layer of fresh water in polders (salt intrusion) affecting natural systems and infrastructures							
Fisheries	changes in the quantity and distribution of marine species, inclusive commercial fish stocks Appearance of new commercial species (migration from south to north) appearance of new harmful species ↗ vulnerability of highly specialised fishery sector							
Land planning / Infrastructures	↗ in flood risk Risk of disruption to transport by waterways (more low-water periods) Impact of heatwaves and amplification by heat islands damage to infrastructure due to high temperatures (buckling of rails, etc.) Risk of disruption of road and rail transport and damage to infrastructure due to snow and frost Shrinkage and swelling of clay Karstic Risk Damage due to the possible increase in storm frequency							
Forests	Modification of the range of forest species (harmful to wood production) More frequent invasions ↗ in damage due to climatic variations (fire, storms, droughts) frost damage ↗ frequency of outbreaks ↗ growth followed by limited increase due to soil fertility and drought Changes to phenology							

Biodiversity	Added pressure on already vulnerable areas (peatlands, etc.) changes in distribution areas Increase in invasions Phenological changes
Energy	↗ in energy consumption (cold chain/ air conditioning in summer) Integrity and capacity of production and transport installations Problem of cooling of nuclear plants 1 Management of the network and electricity consumption 2 ↘ in heating-related energy consumption Seasonal modifications of photovoltaic, wind and hydraulic production and biomass productivity
Health	↗ in mortality due to heatwaves and diseases linked to food contamination ↗ of respiratory diseases and allergies (pollens..) ↘ mortality in winter Sanitary risks due to air quality (summer) sanitary risks due to air quality (winter) ↗ in diseases linked to water contamination ↗ in vector-borne diseases
Water Resources and Management	Pollution of ground water by leaching Decrease in surface water quality (floods, streaming, low-flows) Variation in river flows can lead to pollution increased rainfall in winter recharges grondwater Reduction of ground water in summer
Tourism	Longer periods of favourable conditions for low-season tourism Favourable conditions for summer tourism but risks for nautical activities during dry summers Energy consumption for heating Energy consumption for cooling
Industry & services	Impact on production processes (e.g. water shortages, cooling of power plant, etc.), direct (flooding, high winds, etc.) and indirect (supply problems) damages More frequent and/or intensive weather-related disasters will challenge insurance systems
Legend	very serious serious not very serious opportunities impact difficult to assess

1. Changes to the facilities (complete closure of Tihange site expected in 2025) should significantly decrease the pressure on surface water. Note: there is also a risk in inter-connected facilities and a direct risk in Wallonia.

2. The changes to the facilities will lead to changes in electricity management methods (very high costs)

Table 6.2: Adaptation measures implemented by sector

Sector	Adaptation measures
Water management	Widespread information campaign to encourage water savings. Flood Risks prevention and management framework (regional plans). Update flood part of the national emergency plan 'natural disasters' (on-going) which foresees prevention measures such as closure of the riverside walls of the river Scheldt; defence mechanisms to protect from high water and tide levels at the coast, etc. Inclusion of cover for floods (and other natural disasters) in household fire insurance policies. Technical specifications for construction linked to water courses that allow for an increase in temperature of 2 °C. Valuing water as biodiversity vector and temperance element of the urban microclimate
Coastal areas	Coastal safety master plan. Coastal defence allowing for the coast's natural dynamic. CREST project (2015-2019) aiming to increase the knowledge of coastal processes near the coast and on land. The project will i.a. determine the resilience of the natural coastal system (dunes and beaches) in relation to storms and wind.
Biodiversity	Network of protected areas (Natura 2000). Bioclimatic classification of species. Monitoring of the effects of climate change on biodiversity: exploratory study about the impact of climate change on birds; follow-up of the flowering dates of fruit trees; follow-up of phenological indicators. Mainstreaming of adaptation in the National Biodiversity strategy. Mainstreaming of climate change in the program of measures (2015) to achieve good environmental status of marine waters (deadline: 2020).
Agriculture	New Climatic Agri-environmental measures: actions on a voluntary base which take into account climate change challenges (e.g. part of grassland reserved to flood plain). Inventory of opportunities for adaptation in agriculture (and horticulture) and information campaign (brochure entitled "*Goed geboerd? Ook het klimaat is u dankbaar!* [Done your bit? And the climate is in your debt too!], seminars, articles, etc.) in the Flemish Region. Creation of a research and technical information centre for soil erosion in the Walloon Region (more than 100 realisations between 2011 and 2015 in 80 municipalities, publication of a good practices guidance...). Impact studies on the impact of climate change on agricultural crop performance and yields performed in the context of CORDEX.be [12]
Forests	Allowance made for climate change in the Walloon Forest Code and Brussels plan for managing the Forêt de Soignes/Zoniënwoud woodland area. Diversification of species and conservation of ecosystems that are relatively unaffected by human activities. Update on-going of two main documents (the recommendations for policy makers [8] and the good practice guide for forest managers) by a group of experts responsible for studying the impact of climate change on forest ecosystems. Monitoring of the forest health by the Walloon forest health observatory and permanent inventory of the health of the Forêt de Soignes/ Zoniënwoud woodland area (monitoring changes in oak and beech trees). Partnerships in place with the Brussels Region and France to facilitate real time exchange of information on diseases for the purposes of concerted management at interregional level. FORBIO climate project (on-going project funded by BELSPO) scrutinizes the adaptive capacity of tree species (with a focus on oak and beech) and aims to predict the future performance of tree species under different climate scenarios.
Fishing	Research and monitoring of the effects of climate change on the fish populations (ILVO, Flemish region).

Sector	Adaptation measures
Infrastructures and urban environment	Adoption of climate change adaptation measures for infrastructures and the urban environment (combating the consequences of soil seal, increased revegetation in the urban environment, etc.). IVB interregional project, "Future Cities – urban networks to face climate change", aiming at adapting urban structures to the likely effects of climate change. Impact studies on the impact of climate change on urban heat stress and urban environment performed in the context of CORDEX.be [12] Mapping of the freshness islands in the Brussels area (on-going). Mapping of urban heat islands in the Flemish region (VMM-MIRA, on-going).
Transport	The North Sea Disaster Prevention and Management plan (to combat exceptionally high tides). "Summer" and "winter" plans drawn up by public transport managers (SNCB/NMBS and Infrabel, TEC, de Lijn, STIB) in order to anticipate and mitigate the disruption of services caused by extreme weather conditions. Development and update of specific models for predicting the rail adhesion index, the freezing of catenaries and the icing of overhead lines to be able to respond to specific transport needs. Mapping of the vulnerable parts of the Belgian railway system based on the meteorological data and climate forecasting (on-going). Implementation of corrective measures: new design of the draining systems of the railway lines, preventive actions to reduce the number of trees falling on railway lines…
Industry & services	Through the "new industrial policy", research into a new approach/ other procedures for Flemish industry. Coverage against flooding and other natural hazards is included in (voluntary) household fire insurance policies since 2007 (if a new construction is located in a "high risk area", the insurer is not required to provide coverage against flood damage, flood maps are available for Wallonia and Flanders).
Energy	Promotion of sustainable energy generation methods independent of the availability of water resources. Promotion of building insulation. Study on needs in adequation and flexibility of electric system (2016)

Sector	Adaptation measures
Tourism	Involvement of "Toerisme Vlaanderen" in the Sigma plan to control flooding zones. Cooperation agreement between that tourism body and the Maritime Services and Coast Agency (MDK), responsible, *inter alia*, for managing coastal defences.
Health	New versions of federal and regional heat and ozone plans (2016 and 2017), taking into account one decade of experience in Belgium. The revised plans make explicit reference to climate change as one of the main risk factors. New National Medical Intervention Plan (2017) taking into account all natural or man-caused disasters. Large surveillance system of air allergens and pollutants (pollen, particulate matter, CO_2, NO_x, etc.) In follow-up of the MODIRISK programme (leading to eradication measures of the *Aedes japonicus* mosquito), work is on-going to establish a Belgian monitoring plan of exotic mosquitoes. Systems of identification and surveillance of infectious and vector borne diseases which can be linked to climate change. These systems include list with notifiable diseases (including new or unusual diseases such as Lyme disease, malaria, zika, etc). Establishment of a national platform for information exchange and cooperation regarding foodborne diseases due to division of competences (incl. food safety and health authorities). On-going work on short term effects of atmospheric pollution and of the climate on all-cause mortality in Belgium and on modelling the impact of temperature on the epidemiological evolution of infectious diseases (WIV-ISP). Launch of a call for the development of e-training modules for medical doctors and specialists on environment and health issues, taking climate change impacts on health into account.

Sector	Adaptation measures
Disaster risk management	Emergency/action plans established for forest fires or floods. BE-Alert: channels for notification of the population in the event of a crisis. Systematic collection of data on natural disasters (e.g.: EM-DAT, disaster database developed by the Center for Research on the Epidemiology of Disasters). Collection of information / experiences after interventions / incidents. Belgian risk analysis conducted in 2016 identifying 10 risks (including floods and heat waves). Establishment of a national platform for disaster risk reduction (Sendaï platform) in 2016.
Research	Several research projects have been launched to increase knowledge of climate change impacts and adaptation (for more information, see Chapter 8) i.a. MACCBETH - Modelling atmospheric composition and climate for the Belgian territory (2010-2015), STOCHCLIM (on-going project aiming to improve the understanding and description of key physical processes in climate models of increasing complexity, with emphasis on the improvement of the variability of dynamical phenomena acting on monthly, seasonal and decadal time scales), cordex.be (see Chapter 6.2.2), FORBIO climate (cf section 'forests), PAMAXEA (aiming to improve understanding of climate trends and extremes in East Africa as basis for appropriate water-resource management, etc.), PLURISK (Forecasting and management of extreme rainfall induced risks in the urban environment, 2012-2016), MASC (Modelling and Assessing Surface Change impacts on Belgian and Western European climate), etc.

Sector	Adaptation measures
Transversal issues and collaborations	Development of guidance documents in order to promote integration of biodiversity and climate change issues into Environmental Impact Assessment and Strategic Impact Assessments in Belgium. Integration of adaptation in the analysis procedure for federal regulation (AIR – analyse d'impact de legislation) as well as in the manual for impact analysis for regulation. Establishment of a Climate Citizens Parliament in the province of Luxembourg. The parliament has made recommendations to the Province Council. Allowance for the effects of future climate change in environmental impact surveys. Support of the Walloon government to cities and municipalities who signed the Covenant of Mayors: Wallonia gives funds and provides tools to help municipalities develop local energy & climate plans (mitigation and adaptation tools). Launch of a platform dedicated to the ecosystems services (map, identifications, evaluations ...) in Wallonia Support of the Flemish government to local authorities in their adaptation processes. Development of a platform www.burgemeestersconvenant.be (Covenant of Mayors) providing information on CO_2 emissions in Flanders, renewable energy atlas and 30 relevant adaptation measures, 15 good practices on adaptation and a guide through different funding channels. Establishment of a "Think Tank on Climate Change Adaptation" in Flanders (2015 – 2017) involving different stakeholders (industry, civil society, scientists and authorities). A closing-event presenting the outcome of the thinktank will take place on December 14th.

6.4. Cooperation on adaptation

6.4.1. Development cooperation

Belgian development cooperation has explicitly included the fight against climate change as a priority in its policy since 2008. This is because the consequences of climate change on countries in the South is a significant source of instability in terms of food safety, degradation of biodiversity, migration, public health and tensions that sometimes even culminate into conflicts. These countries are the first victims of climate change because they bear less responsibility for its consequences and have fewer resources in their fight against it. The new Belgian Development Cooperation Act, published on 19 March 2013, includes the protection of the environment and natural resources, as well as the fight against climate change, as one of two important transversal priorities. Failing to take the possible impact of climate change into consideration could further partially or fully cancel out all the efforts to combat poverty and the achievement of the Millennium Development Goals.

In order to facilitate the integration of this priority, the KLIMOS research platform [10], a consortium of several Belgian universities with a network of universities in the South, developed an Environment Sustainability Toolkit. Various initiatives for capacity building within Belgian development cooperation were organised. The Belgian development cooperation is supporting sustainable development in least developed countries. For climate actions Belgium focuses its international finance on adaptation, through funds such as the least developed countries fund. Further details on financial resources are discussed further in this national communication.

Belgian development cooperation contributes towards greater public awareness of climate-related problems by means of publications and other awareness activities.

6.4.2. International scientific research

Belgium supports international agricultural research, inter alia by means of the Consultative Group on International Agricultural Research (CGIAR). This group supports 15 research centres aiming to ensure improved food safety, improved human nutrition and health, a higher income for the poor and improved management of natural resources, on the basis of scientific findings. New crop varieties, knowledge and other research products are made available to individuals and organisations dealing with sustainable agricultural development throughout the world. Around one-third of the research programmes fall under the scope of the fight against climate change and its impact. Centres such as IITA, CIAT, ICRISAT, ICARDA and WARDA carry out research into modified agricultural crops. The World Agroforestry Centre, ICRISAT, ICARDA and IITA research adapted agricultural techniques and identify innovations at institutional and policy level for better agricultural management in response to climate change. The aspect of capacity building is obviously an important motivation for Belgian support to a research environment such as CGIAR. Belgium is also collaborating with different partners at European level. Especially on the impacts, vulnerability and adaptation assessment, Belgian institutions are represented in different European research networks (e.g. CIRCLE and CIRCLE-2, JPI). Belgian universities participate in European research projects (e.g. EU Cities Adapt, SIC-ADAPT!, AMICE, Future Cities, TIDE, SUDEMCLL, BLAST, SAFECOAST, Ourcoast, ClimateCost, Espace, Climate proof Areas).

6.4.3. Benelux collaboration

In 2014 the collaboration between Belgium, the Netherlands and Luxemburg started through a working group piloted by the Benelux General Secretariat.

This working group organized a conference in November 2014 to identify potential transboundary issues. Four priority topics have been identified and during 2015 and 2016 four workshops were organized to discuss how to collaborate on energy, public health, transport and disaster risk reduction. The report 'Climate change adaptation in Benelux 2015-2016' summarises the content and results of these workshops and provides information on adaptation policies in the Benelux countries. ■

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7. Financial Resources and technology transfer

Introduction

Over the period 2013-2016, Belgium provided 334.1 million EUR of public support to developing country Parties, mainly through grants and some concessional loans. This financial, technological and capacity-building support to non-Annex I Parties mainly focused on:

- Predominantly adaptation and cross-cutting activities;
- Provision of bilateral and multilateral support under the form of grants;
- Contributions mainly directed towards Africa and Least Developed Countries (LDCs);
- Contributions to climate-specific multilateral funds (Green Climate Fund, Adaptation Fund, Least Developed Countries Fund, etc.) or specialized UN agencies;
- Mainly in the following sectors: multisectoral, agriculture and livestock, energy, water and sanitation and environment.

At the Conference of the Parties in December 2015 Belgium announced that it would contribute at least 50 million EUR yearly to international climate finance. According to a negotiated internal distribution ratio the federal government accounts for half of this yearly commitment. The regions provide the other half as follows: 14.5 million EUR by the Flemish region, 8.25 million EUR by the Walloon region and 2.25 million EUR by the Brussels Capital region[1].

In parallel to its long-standing provision of public climate finance to developing countries, Belgium also supports the efforts of developing countries to implement low-emission, climate-resilient projects and programmes by (i) providing significant core funding to multilateral organizations and (ii) mobilizing, through public means, private investments for climate-related projects in developing countries.

[1] More information on the Belgian burden-sharing agreement are available on the website of the National Climate Commission

7.1 Legislative and institutional framework of climate change policies and programmes

Belgium is a federal state and due to this institutional context several federal and regional level government departments are involved in the development and implementation of climate change policies.

As the regional governments have competencies in fields that are connected with their region or territory (water policy, the environment, nature conservation, etc.) and have powers relating to international relations in those fields, they are also playing an active role in the international aspects of climate change, such as providing and mobilizing climate finance.

A cooperation agreement on the internal burden sharing of Belgium's climate and energy objectives for the 2013-2020 period was reached in October 2016. This agreement should enable Belgium to respect its European and international commitments in climate and energy policy by 2020. It focuses on greenhouse gas emissions reduction targets for non-ETS sectors, the share of renewable energies in final energy consumption, and the contribution to international climate finance. Regarding the contribution to international climate finance, an internal distribution ratio is agreed to meet Belgium's announcement to contribute annually EUR 50 million in 2016-2020:

- Federal government: EUR 25 million
- Government of Flanders: EUR 14.5 million
- Government of Wallonia: EUR 8.25 million
- Government of Brussels-Capital Region: EUR 2.25 million

The federal part of the Belgian climate finance is mainly delivered through the budget for development cooperation. The law on development cooperation of 19th March 2013 sets out the goals and priorities of Belgium's international cooperation. This law stipulates that in its programmes and activities of development cooperation Belgium strives towards sustainable and inclusive economic development and poverty alleviation. Furthermore, in this law the protection of the environment and natural resources, including the fight against climate change, desertification and global deforestation is set out as a priority. Overall policy coherence for development is an important priority of Belgium's development cooperation.

7.2 Provision of international climate finance through official Development Assistance and other official flows

Belgian climate finance focuses on adaptation and crosscutting activities, with 45% and 34% respectively, as presented in the Figure 7.1.

Programmes and projects are mainly developed in the following sectors: agriculture and livestock, energy and water and sanitation. The large share of funds labeled as multisectoral is mainly due to a large part of finance contributed to multilateral financial instruments. An overview can be seen in the Figures 7.2, 7.3 and 7.4.

Belgium continues to enhance its reporting on climate finance in order to report as complete, transparant and correct as possible. In this context some minor errors and omissions were corrected in CTF Tables 7a and 7b for 2013 and 2014 (update figures for 2013 and 2014 are available on the website of the NCC).

Figure 7.1: Belgian climate finance-type of support 2013-2016 in EUR

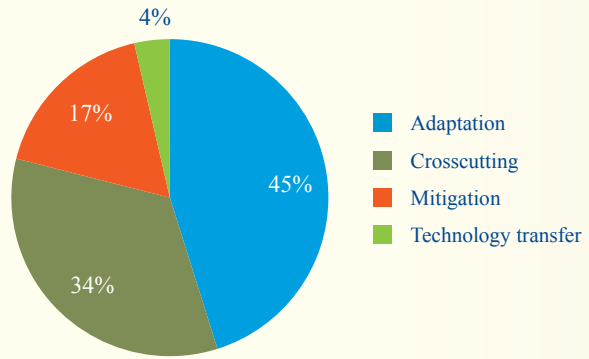


Figure 7.2: Belgian Climate Finance 2013-2016 per sector – category other includes: climate policy, support to civil society, rural development, public sector, education, agriculture and food security, health, transport, forestry, fisheries and others

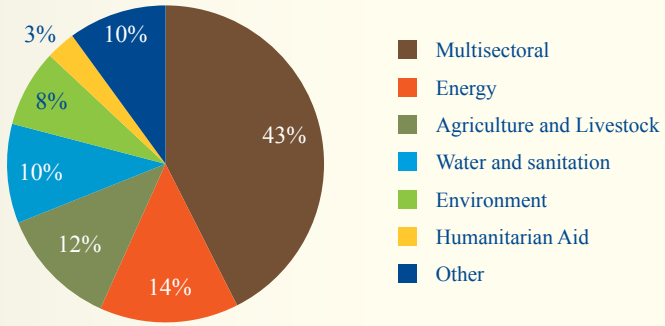


Figure 7.3: Contribution to international climate finance - federal and regional governments

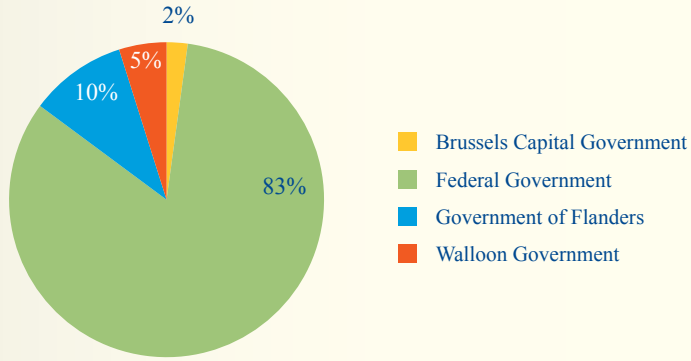
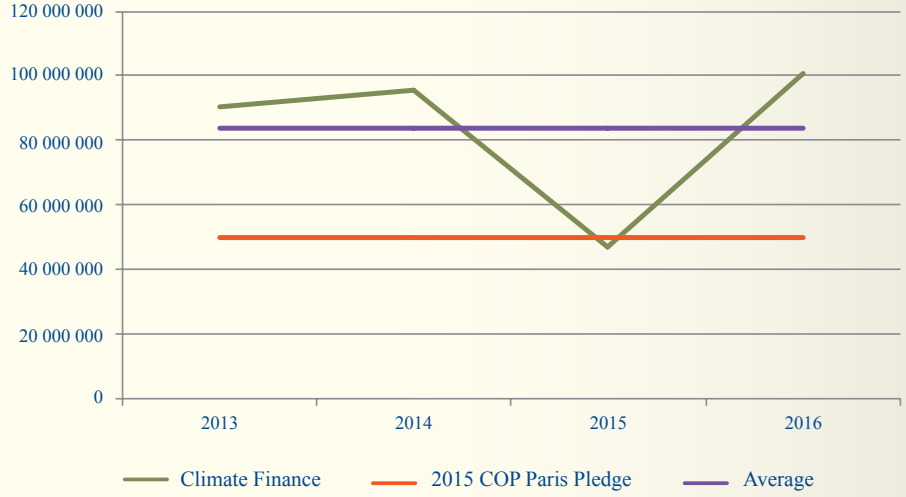


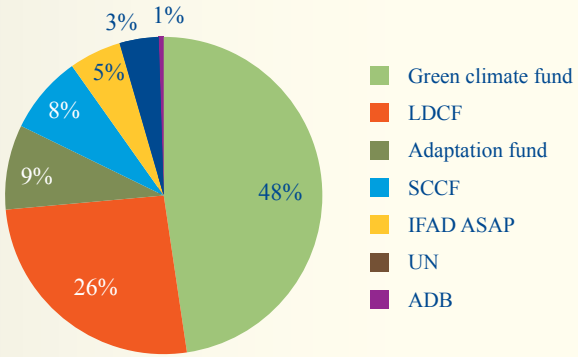
Figure 7.4: Belgian contribution to International Climate Finance- per year



7.2.1 Financial contributions to multilateral institutions and programmes

As a long-standing donor in terms of climate finance, Belgium's federal and regional governments contribute to the Green Climate Fund (GCF), the Global Environment Facility (GEF), the Least Developed Countries Fund (LDCF) and the Adaptation Fund, and they provide non-earmarked contributions to multilateral institutions and specialized UN agencies. In total Belgium provided climate finance of 150.5 million EUR to several funds and organizations in 2013-2016 (see Figure 7.5 overview of contributions to multilateral funds in 2013-2016).

Figure 7.5: Multilateral Climate Finance 2013-2016 per organization/fund



Federal Government

The majority of multilateral funds come from Belgium's development cooperation budget, which has sustainable development and poverty alleviation as the most important goals.

In 2009 Belgium adopted a strategic core policy towards its multilateral partner organizations. This means that most contributions are un-earmarked and preferably multiannual to allow for stable, secure and predictable funding and to increase transparency and efficiency.

In 2016 new Framework Arrangements were signed between the federal government and its 15 multilateral partner organizations. These FA's are used to underline the commitment to work jointly to implement the 2030 Agenda for Sustainable Development and as a basis for long term cooperation.

Organizations such as the Food and Agriculture Organization (FAO), United Nations Development Programme (UNDP) and United Nations Environment Programme (UNEP) contribute significantly to the fight against climate change through the programmes and projects in their portfolios. Belgium also supports the Consultative Group on Agricultural Research with core resources. Agricultural research is indispensable to help secure food and nutrition security in vulnerable countries and improve farmers livelihoods. In implementing their new strategy CGIAR plans to devote 60% of their resources towards research in the areas of mitigation, resilience to climate shocks and adaptation.

Other multilateral partners of Belgium such as the World Bank Group play an important role in mobilizing international climate finance. Of course Belgium also contributes to the different funding instruments of the European international cooperation (through the EU budget, the European Development Fund and European Investment Bank), which fund several programmes and activities to mitigate climate change and support countries in their adaptation efforts. For example, 27% of the Global Public Goods Programme of the EU Development Cooperation Instrument is dedicated to climate change and other environmental issues.

An overview of core contributions to these organizations is included in CTF Table 7(a), but these are not reported as specific climate finance.

During 2014-2016, Belgium provided yearly 18.6 million EUR to the Global Environment Facility, an operating entity of the financial mechanism under the UNFCCC. This contribution is also un-earmarked.

In addition to the provision of these core resources, within the available resources for development cooperation, a significant part of the multilateral finance was specifically targeting multilateral climate change funds. These include contributions to the Green Climate Fund, the Least Developed Countries Fund, the

Special Climate Change Fund and IFAD's Adaptation for Smallholders Agricultural Programme. Considering the needs of the most vulnerable countries, Belgium therefore focused its support on financing adaptation activities and on strengthening the resilience of least developed countries. Together with the Green Climate Fund, which received a contribution of 50 million EUR from the federal government, the LDCF was a significant channel through which the federal government provided large parts of its international climate finance. In 2016 a multi-annual contribution of 24 million EUR was committed to the fund for the period 2016-2018, which was complemented with additional resources of 8 million EUR in 2016. In total in the reporting period 2013-2016 39 million EUR was contributed to the LDCF. This makes Belgium the fourth top contributor to the LDCF, constituting more than 15 % of the total funds available there.

Government of Flanders

The Government of Flanders has contributed to the Green Climate Fund (3.5 million EUR in 2015 and 6.25 million EUR in 2016). The GCF, created by the UNFCCC, aims to support a paradigm shift in the global response to climate change and to mobilize funding at scale to invest in low-emission and climate-resilient development in developing countries. The Fund pays particular attention to the needs of societies that are highly vulnerable to the effects of climate change, in particular Least Developed Countries (LDCs), Small Island Developing States (SIDS), and African States.

The Government of Flanders also provided support through the Adaptation Fund (1 million EUR in 2014 and 6.25 million EUR in 2016), which finances projects and programmes that help vulnerable communities in developing countries adapt to climate change.

Table 7.1: Contributions to the Global Environment Facility

Contributions to the Global Environment Facility (in EUR)	2013	2014	2015	2016
GEF Trust Fund	17 000 000	18 600 000	18 600 000	18 600 000
Least Developed Countries Fund	12 000 000	12 000 000	0	15 000 000
Special Cimate Change Fund	12 000 000	0	0	0

2 million EUR are disbursed in the African Climate Change Fund (ACCF). The ACCF, managed by the African Development Bank (AfDB), provides technical assistance to African countries to access international climate finance.

Government of Wallonia

The Government of Wallonia has provided financial contributions to Green Climate Fund (1.374 million EUR in 2015 and 7 million EUR in 2016) in order to finance adaptation and mitigation projects.

The government of Wallonia has also made contributions to the Adaptation Fund (250 000 EUR in 2015 and 1 million EUR in 2016) to support its projects and programmes, which play an important role in achieving the Paris Agreement objectives.

Government of the Brussels-Capital Region

In order to provide a fair understanding of the multilateral support financed by the Brussels-Capital Region, the period of 2013, 2014 and 2015 is first described then followed by the year 2016. The Brussels-Capital Region only reports climate finance that is disbursed and directed to Non-Annex I Parties or to multilateral funds and that is new and additional; meaning funded through new and additional revenue as required by the regional legislation[2].

[2] Brussels code on Air, Climate and Energy

The Government of the Brussels-Capital Region has disbursed financial contributions to the Adaptation Fund (500 000 EUR in 2013), supporting adaptation projects to the most vulnerable countries. The Government of the Brussels-Capital Region has also been contributing to provide climate finance to the Green Climate Fund (600 000 EUR in 2014 and 500 000 EUR in 2015). Those disbursements aimed to finance adaptation and mitigation projects and to support the 'pipeline project' of the Green Climate Fund.

As of 2016, an internal burden sharing distribution of the Belgian climate finance international commitments has required the Government of the Brussels-Capital Region to provide 11 250 000 EUR to climate finance for the years 2016-2020. The Government of the Brussels-Capital Region has disbursed by now new and additional financial contributions to the Adaptation Fund (2 500 000 EUR in 2016) and to the Green Climate Fund (2 500 000 EUR in 2016) for this period.

7.2.2 Bilateral and Regional Financial Contributions

Climate finance through bilateral channels includes disbursements in the context of an agreed partnership programme with a partner country. Programmes and projects in this framework are implemented by different organizations such as the Belgian Technical Cooperation multilateral organizations, other donor (delegated coopera-

tion), civil society organizations or directly by national or local partners in the South.

A top 20 of recipient countries can be seen in Figure 7.6.

Federal Government

In 2015, Belgium renewed its list of partner countries and decided to focus most of its support on 14 countries: Benin, Burkina Faso, Burundi, DR Congo, Guinea, Mali, Morocco, Mozambique, Niger, Palestinian territories, Rwanda, Senegal, Tanzania and Uganda. These partner countries of governmental cooperation were selected on the basis of their degree of poverty, aspects of good governance and Belgium's potential for providing meaningful support.

In parallel to the bilateral support provided to these 14 countries, Belgium also supports civil society organizations that operate in a wider range of developing countries.

In the reporting period, bilateral finance provided by the federal government amounted to 155 million EUR.

The federal government aims to direct 50% of its ODA towards Least Developed Countries. Bilateral climate finance by the federal government reflects this policy towards Least Developed Countries in Africa. 47% of bilateral climate finance is directed towards activities in LDC's. The focus of most climate related programmes and projects is on adaptation. Again, most programmes and activities are implemented in agriculture and livestock, water and sanitation, energy and environment.

The Belgian Investment Company for Development Cooperation (BIO) is another important actor in providing funds for climate investments. Its mission is to support a strong private sector in developing and emerging countries, to enable them to gain access to growth and sustainable development within the framework of the Sustainable Development Goals. Their climate portfolio mainly consists of projects in the renewable energy sector, mostly by providing loans and equity. During the reporting period BIO significantly upscaled its investments in climate related activities. Its overall portfolio represented commitments of 400.1 million EUR, of which 20% can be considered climate finance. Loans provided by BIO in the period 2015-2016 are included in CTF Table 7b. The OECD methodology was used to calculate the grant equivalent for these loans. For equity or mezzanine type invest-

Figure 7.6: Top 20 of recipient countries of Belgian bilateral climate finance in 2015-2016 (in EUR)

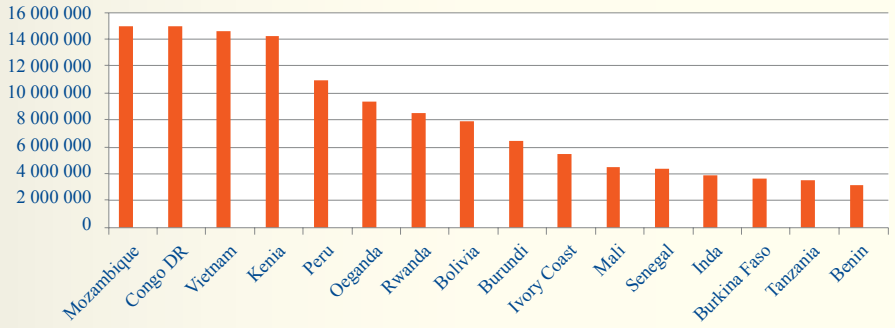
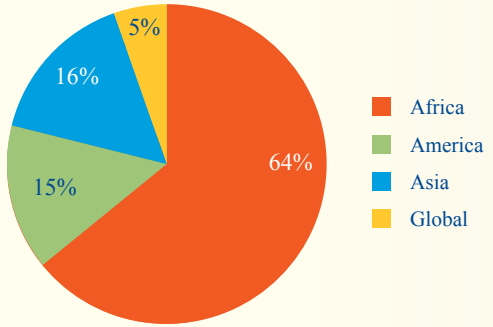


Figure 7.7: Bilateral Climate Finance: distribution per region (2013-2016)



ments there is no agreed methodology to calculate the grant equivalent. Therefore this type of investment was not included in the reporting tables, but an overview of all climate related investments by BIO is included in Table 7.2.

Government of Flanders

Each year, the Government of Flanders reserves 2 million EUR of development cooperation for climate finance projects. This budget comes on top of the annual budget for bilateral development cooperation (of 5 million EUR per partner country (South Africa, Malawi, Mozambique). This funding is focused on specific climate policy measures, in line with mutually agreed sectoral focus areas, which are job creation, health and agriculture & food security. The alignment to the focus areas enhances the effectiveness and predictability of this funding.

Next to these funds, the Government of Flanders supported the World Food Programme and World Agroforestry Centre, in implementing climate projects on, respectively, food security and agroforestry in Malawi. The Government of Flanders also invests in the Flemish Partnership Water for Development and Flemish Fund for Tropical Forests, two initiatives on water and forestry management in developing countries.

Projects and programmes with a significant or principle focus on climate change are also reported to UNFCCC, to ensure full transparency and to reflect the level of mainstreaming climate change within development cooperation.

Government of Wallonia

As of 2011, the Government of Wallonia has provided additional and specific support to climate change projects (both mitigation and adaptation) in developing countries. This support has been administered by the Walloon Agency for Air and Climate (AWAC). A special budget line has been created on top of the annual budget for bilateral development cooperation. Between 2013 and 2016, 23 projects have been funded. The funds disbursed in bilateral projects amounted 1 652 243 EUR in 2013, 640 883 EUR in 2014 and 1 202 935 EUR in 2015.

Historically, the Walloon Region has supported development cooperation projects in areas of its competencies such as education, agriculture, water management, job creation, environment, etc. This cooperation has been administered by Wallonie-Bruxelles International (WBI). WBI's project portfolio has evolved over the years. Since 2013, it includes projects and programmes with a significant or principle focus on climate change. Those initiatives are also reported to UNFCCC, to ensure full transparency and to reflect the level of mainstreaming climate change within development cooperation. The funds disbursed by WBI in bilateral projects amounted 642 034 EUR in 2013, 446 134 EUR in 2014 and 246 066 EUR in 2015.

Government of the Brussels-Capital Region

In order to provide a fair understanding of the bilateral support financed by the Brussels-Capital Region, the period of 2013, 2014 and 2015 is first described, then followed by the year 2016. The Brussels-Capital Region only reports climate finance that is disbursed and directed to Non-Annex 1 Parties or to multilateral funds and that is new and additional; meaning funded through new and additional revenue as required by the region's legislation[3].

The financial support provided by the Brussels-Capital Region was concentrated in multilateral funds (namely the Adaptation Fund and the Green Climate Fund) during the period 2013-2014. In 2015, the Government of the Brussels-Capital Region supported additional funding to climate specific projects. In this regard, climate specific projects have been funded throughout additional disbursements, such as 250 000 EUR disbursed to the *Organisation de la Francophonie* in 2015 funding two initiatives; one about sustainable development in the cities, one targeting women and climate change projects.

As of 2016, an internal burden sharing distribution of the Belgian climate finance international commitments has required the Government of the Brussels-Capital Region to provide 11 250 000 EUR to climate finance for the years 2016-2020. In this prospect, The Government of the Brussels-Capital Region has disbursed new and additional financial contributions to three projects: one project taking place in the Republic Democratic of the Congo to raise awareness to the changing environment where women are helped to better handle their immediate environment

Table 7.2: Climate Finance investments by BIO 2013-2016 (net commitments excluding exits)

year	Total net commitments (EUR)	Climate Finance (EUR)	%
2013	91 538 365	0	0
2014	85 490 970	31 179 773	36.5
2015	84 236 622	1 000 000	1.2
2016	138 862 133	49 984 500	36
Total	**400 128 090**	**82 164 273**	**20.5**

[3] Brussels code on Air, Climate and Energy.

(112 747 EUR) and a second also taking place in the Republic Democratic of the Congo, aiming to mobilize the local community to better manage the impact of climate change (119 904 EUR).

Thirdly, the Government of the Brussels-Capital Region has supported the process of building a new eco-center in Morocco to better deal with waste management and reduce the emission of CO_2 (38 821 EUR).

Finally, in addition to its climate finance international commitments, the Government of the Brussels-Capital Region has also financed two projects with relevant[4] climate impacts in Morocco (54 000 EUR) and in the Republic Democratic of the Congo (37 105 EUR) as part of Official Development Assistance projects.

7.3 Activities relating to transfer of and access to technologies and capacity building

An overview of activities related to technology transfer and capacity building can be found in CTF Table 8 and 9.

Capacity building and to some extent technology transfer are always an essential component of all bilateral programmes and projects. In the tables some of the more concrete examples related to mitigation and adaptation are listed.

The Belgian Development Cooperation supports both the VLIR (Flemish inter-university council) and CIUF (Conseil Interuniversitaire de la Communauté française de Belgique) to establish partnerships between Belgian universities and university colleges and their counterparts in the South. These partnerships generate – among other projects – initiatives related to climate change.

In 2014, Belgium also established the Academic Research Platforms for Policy Support (ACROPOLIS) which provide policy support for development cooperation, based on quality academic research. One of these platforms – KLIMOS- focuses on environmental sustainability and climate change. Its main goal is to build capacity for the sustainability transition. Through this research platform, the government provides seed money that is used to (i) conduct case studies in the South, (ii) establish collaborations with research institutions in the South and (iii) build capacity both in Belgium and in its partner countries. The four research streams include: sustainable management of natural resources, sustainable energy and infrastructure, good governance for environment and sustainability, sustainable monitoring and evaluation.

The Flemish Water for Development Partnership – involving over 90 project partners, ranging from NGOs, public water companies, private firms over local authorities and regional administrations to academic and research institutions active in the water sector – implements sustainable water and sanitation projects in the global South. The climate support through this Partnership is reflected in CTF Tables 7(b), but these projects also foster the transfer of expertise to southern partners. To date, these projects benefited over one million southern citizens in terms of access to water.

In accordance with UNFCCC guidelines, Belgium reported activities related to technology transfer, including success and failure stories. Description of selected projects or programmes that promoted practicable steps to facilitate and/or finance the transfer of, or access to, environmentally-sound technologies is provided in Annex 4.

[4] Applying the Rio Marker methodology, only 40 % of the disbursed finance is reported as the climate impacts are significant but not principal to the objective.

7.4 Mobilization of Private Sector support through public intervention

In addition to playing its part in providing public climate finance, Belgium is directing its efforts towards mobilizing flows of private finance for climate-related projects in developing countries, as this is pivotal to achieving long-term transformation of developing countries into low-carbon and climate-resilient economies.

7.4.1 Actors and channels to mobilize private sector support

During the period considered in this report, the following actors undertook the most significant actions to directly mobilize private flows in developing countries.

BIO-invest

During the period 2014-2017, BIO approved 14 investments in renewable energy projects for a total amount of EUR 139 million, both direct investments and indirect investments made through renewable energy funds. Of these projects, 12 are signed or finalizing legal documentation (EUR 118 million)[5].

Of the 12 portfolio projects mentioned above, 4 projects (2 investment funds and 2 syndicated loans) mobilized private investors. In the context of these 4 investments, for which BIO contributed USD 37.8 million, BIO estimates it mobilized a total amount of USD 13.488 million private investment. The share of private sector investment in the total amount financed amounts to 33 %. BIO has taken an active role in mobilizing private investors for renewable energy projects by, for example, inviting the private bank Triodos on board for an investment deal.

To calculate the above-mentioned amount of private climate finance it mobilized, BIO used the methodology developed by the OECD. This methodology attributes the mobilization of private investors to the different public investor participants according to the instrument used (syndicated loan, guarantee or collective investment vehicle) and their role in arranging the investment.

Credendo

By providing a range of products covering trade and investments risks in developing countries, Credendo, the Belgian credit insurance group, also contributed to mobilizing private climate finance. Over the past reporting period, Delcredere covered several dredging projects aimed at mitigating the ecological and social impact of coastal erosion in developing countries (Ghana, Benin, Sri Lanka) and was involved in wind farm projects and solar power stations (Kenya, Chili, South Africa and Madagascar). It is currently not possible to provide a quantified estimate of the amount of private finance mobilized via these various projects due to the current lack of definitions, methodology and data related to the tracking of private climate finance.

FINEXPO

Through its various instruments combining public financing with commercial financing, FINEXPO, a Belgian federal committee on financial support for exportation, is also an important player involved in mobilizing private climate finance in developing countries.

Over the past reporting period, FINEXPO was for example involved (often in co-ordination with Credendo) in a wind farm project in Kenya and in various dredging projects aimed to combat coastal and river erosion (Ghana, Vietnam, Philippines…). During the reporting period considered, FINEXPO also developed an instrument aiming to support SME investments in developing countries that could be of great use e.g. in the sector of renewable energy. Similarly as with Credendo, it is currently impossible to provide a quantified estimate of the amount of private finance mobilized via these various projects due to the current lack of definitions, methodology and data related to the MRV of private climate finance.

Other actors and channels used by Belgium to mobilize private climate finance

Even if the above-mentioned bodies are currently the main actors in Belgium, other institutions also contribute to the scaling-up of private finance supporting low-carbon climate-resilient activities in developing countries. Further efforts to collect and report more granular information about the undertakings of these actors will be made, but this proves to be challenging from an individual Party perspective.

Over the period 2013-2016, Belgium also contributed to mobilize private climate finance through its 642 million core funding to World Bank Group, African Development Bank, European Investment Bank, Asian Development Bank, Inter-American Development Bank and European Bank for Reconstruction and Development. While it is currently impossible to provide a quantified estimate of the impact that this financial support has had, the work and projects that it made possible undoubtedly contributed to mobilize private climate finance in developing countries during the considered reporting period.

Supporting effective enabling environments in developing countries is also key to indirectly leverage significant amounts of private climate finance on the short- and long-term. In this regard, the efforts undertaken by Belgium to support the development of stable investment frameworks in developing countries should be highlighted. Such support took place both

[5] More information on these projects can be found on BIO's website.

bilaterally (through, for example, Belgium's numerous climate-related capacity building activities, undertaken especially in LDCs) and multilaterally (through, for example, Belgium's active participation and financial support in the work of the International Partnership for Mitigation and MRV). While it is currently impossible to assess the impact of such activities, this represents a significant Belgian contribution to the mobilization of private climate finance in developing countries.

Finally, Belgium undertook efforts at the national level to scale-up the amounts of private finance it mobilizes. For example, in 2016 a federal working group was established with the aim to increase information and experience-sharing between relevant Belgian institutions in view of contributing to the achievement of Belgium's climate finance commitments under the UNFCCC in the most efficient manner. This working group already addressed several times the issue of leveraging private finance with public funds and will keep working on this issue in the future. Complementary to these efforts, the Belgian Development Cooperation also financed a research group (ACROPOLIS) dedicated to studying all sources of financial flows for development cooperation, including the various instruments and modalities to attract private finance (blending, public/private partnerships, debt, equity capital, etc) in view of providing policy-relevant recommendations.

Important considerations

Significant data gaps and methodological uncertainties remain on the issue of mobilized private climate finance. It is important to note that, while Belgium tried to provide as much transparency as possible over the activities it undertakes, the following activities should by no means be considered as a complete and accurate picture of what Belgium mobilized during the years 2014-2017.

In the context of this exercise, Belgium chose to adopt a very conservative approach on the issue of mobilized private finance by providing a general and qualitative overview of the efforts of most of its main actors working on the mobilization of private climate finance flows in developing countries and – where possible – quantitative estimates of some of its actions, based on the current best available data. This approach was decided with the objective to provide as much transparency as is currently possible, while avoiding double-counting and over-reporting at the maximum.

7.4.2 Efforts to improve the tracking and reporting of mobilized private climate finance

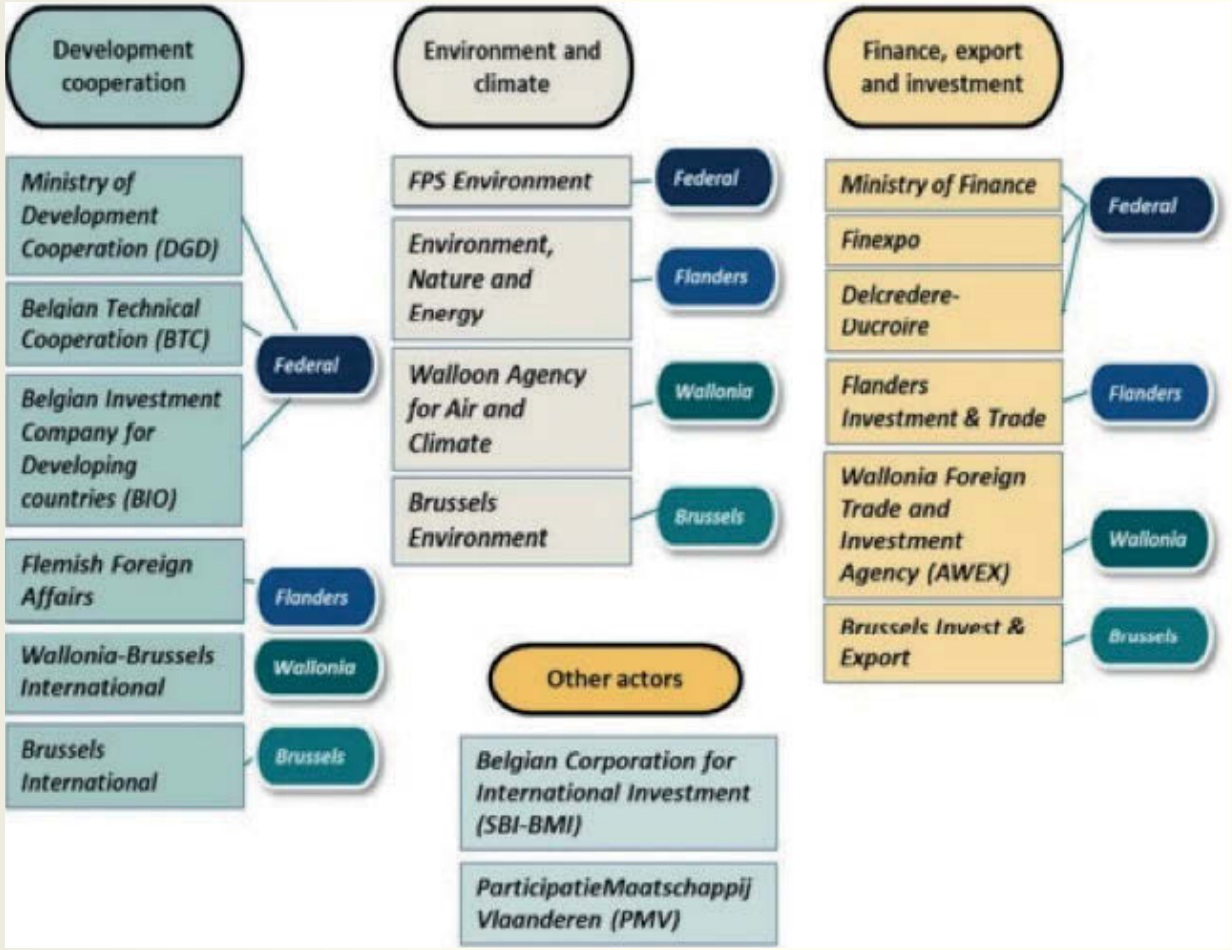
Tracking private flows of climate finance is key to monitor progress in the international effort to tackle climate change (see Figure 7.8). However, to date, there are significant challenges to accurately track publicly mobilized private climate finance in developing countries.

Belgium is engaged in an ongoing process to improve the transparency of its efforts to mobilize private climate finance in developing countries and to accurately track its private finance contributions and progress towards the 100 billion US$ commitment. In this regards, Belgium is actively participating in the work of the OECD Research Collaborative on Tracking Private Climate Finance since its creation, in February 2013.

In addition to that, in 2015, the Federal Ministry of Environment published the results of an important twofold pilot study aiming at (i) better understanding the Belgian landscape of actors involved in the mobilization of private climate finance in developing countries (see Figure 7.8) developing a Belgian methodology to track private climate finance mobilized in developing countries by Belgium during a determined time period. This study, as well as a discussion paper on the lessons learned during this exercise, are available on the website of the Federal Climate Change Service.

Even though the results of this study can only be considered as incomplete and preliminary, this exercise proved to be useful and it provided insights in all of the (practical) complexities and efforts needed to come to an accurate, accountable and transparent methodology to track private climate finance by public sector interventions. The results were used in the context of the OECD Research Collaborative on Tracking Private Climate Finance and are now publicly available.

Figure 7.8: Landscape of the Belgian actors possibly mobilizing private climate finance in developing countries, identified in the study "Promoting private sector actions in the fight against climate change in Belgium and abroad" (2015)



7.5 Methodological approach for tracking the provision of financial, technological and capacity building support to non-Annex I Parties

7.5.1 The use of Rio markers to quantify climate-relevance of projects/ programmes

Belgium uses the Rio markers to report to the Development Assistance Committee of the Organization for Economic Cooperation and Development (OECD-DAC) about the official development assistance that has been spent on activities to support the goals of the United Nations Conventions on biodiversity, climate change and desertification (respectively UNCBD, UNFCCC and UNCCD). These are policy markers that indicate donors' policy objectives in relation to each aid activity. In its reporting to the UNFCCC Belgium uses these markers to identify the relevant programmes and projects in its portfolio.

The Directorate General for Development Cooperation and Humanitarian Aid (DGD), takes all Rio markers (climate, biodiversity and desertification) into consideration to be able to determine the coefficients used to estimate the amount of the project budget that can be considered climate finance. For instance if a project is marked 2 for climate adaptation, as well as for biodiversity, only 50% of the budget would be considered climate finance. For projects that have one or more markers 1, the coefficients (in %) are determined on the basis of their subsector code, also avoiding double counting. To avoid double counting the sum of coefficients for each project never exceeds 100%.

The Governments of Flanders and Wallonia also use the Rio markers. Accounting for "Rio marker 2" actions is simply 100% of the action budget. For accounting the contributions of actions under Rio marker 1 a coefficient of 40% is used. To prevent double counting, a "Rio Marker 2" on both mitigation and adaptation does not result in climate reporting of 200% of the project budget, but counts as 100% of the project budget. The same principle is applied to a "Rio Marker 1" on both mitigation and adaptation, which results in a climate reporting of 40% of the project budget.

Belgium recognizes the shortcomings of using the Rio Markers for quantification, as the purpose of the Rio Markers is to indicate donors' policy objectives in relation to each aid activity, and not to lead to a quantification of support delivered. Unfortunately, there is no better system available that will lead to more precise estimations, without posing an undue burden on Parties reporting. To overcome this hurdle, Belgium reports in the most transparent manner (e.g. publicly available databases) on its climate finance, so future adjustments can be made.

In this regard, all efforts of the Governments of Flanders and Wallonia towards international climate finance are made publicly available on the following websites, respectively:

- The Department of Foreign Affairs of Flanders
- The Walloon Agency for Air and Climate (AWAC)

7.5.2 Key concepts of the methodological approach

Core/general

Core/general contributions are un-earmarked contributions to multilateral organisations. The Belgian development cooperation has a strict core policy since 2009. This means that contributions to Belgian multilateral partners are mainly unearmarked. This choice for unrestricted aid has been made to allow for more efficiency, quality, predictability and flexibility.

Climate-specific

Climate-specific support through bilateral channels relates to support with a score of 2 for the Rio Marker for mitigation or adaptation, of which the full amount is reflected in CTF Table 7(b) and to support with a score of 1 for these Rio Markers, of which only part of the budget is accounted as climate finance and reflected in CTF Table 7(b). With regards to multilateral support (CTF Table 7(a)), climate specific finance is aimed towards funds or organizations with a specific mandate and goals related to the fight against climate change.

Status (committed/disbursed)

Belgium only makes commitments on the basis of a firm obligation such as a decree, and an agreement, expressed in writing and backed by the necessary funds, to provide specified assistance to a recipient country or a multilateral organization.

Belgium aims to report only funds that are disbursed (amounts spent). This means that amounts are reported only when payments have been carried out, on the basis of an invoice or a payment request by a multilateral partner organization or a non-governmental partner. Reporting of disbursements related to projects and programmes of the Belgian Technical Cooperation is based on actual expenses in the field.

Funding source

Official Development Assistance: see definition of the OECD-DAC:

The DAC defines ODA as "those flows to countries and territories on the DAC List of ODA Recipients and to multilateral institutions which are:

i. provided by official agencies, including state and local governments, or by their executive agencies; and

ii. each transaction of which:

a) *is administered with the promotion of the economic development and welfare of developing countries as its main objective; and*

b) *is concessional in character and conveys a grant element of at least 25 per cent (calculated at a rate of discount of 10 per cent)."*

Other official flows

Transactions by the official sector with countries on the List of Aid Recipients which do not meet the conditions for eligibility as Official Development Assistance or Official Aid, either because they are not primarily aimed at development, or because they have a grant element of less than 25 per cent.

Financial instrument

Grant: Transfers made in cash, goods or services for which no repayment is required.

Concessional loan: A loan with a measure of "softness", which is a benefit to the borrower compared to a loan at market rate.

Loan: Transfers for which repayment is required.

Type of support

Adaptation: The support intends to reduce the vulnerability of human or natural systems to the impacts of climate change and climate-related risks, by maintaining or increasing adaptive capacity and resilience. This includes a range of activities from information and knowledge generation, to capacity development, planning and implementation of climate change adaptation actions.

Mitigation: The support contributes to the objective of stabilisation of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system by promoting efforts to reduce or limit GHG emissions or to enhance GHG sequestration.

Cross-cutting: both types of support (adaptation & mitigation).

Sector

Belgium uses the OECD DAC sector classification in its reporting and reports on the level of "main" sectors, such as agriculture, health, education…and not on the subsector level. The OECD DAC's sector classification which is specifically developed to track aid flows and to allow measuring the share of each sector (e.g. health, energy, agriculture) or other purpose category "non-sector allocable aid" (e.g. general budget support, humanitarian aid) in total aid. The sector of destination is assigned by answering the question "which specific area of the recipient's economic and social structure is the transfer intended to foster".

Use of exchange ratio

Belgium decided to use the currency exchange of the OECD DAC statistical table: Annual Exchange Rates for DAC Countries from 1960 to 2016 to comply with this recommendation in the most transparent way.

7.5.3 New and additional financial resources

"New and additional" in accordance with article 4, paragraph 3, of the Convention

Belgium provided support to the Global Environment Facility and the Green Climate Fund, the operating entities of the Financial Mechanism, during the reporting period. The contribution to the GEF is in accordance with the commitment to provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in complying with their obligations under Article 12, paragraph 1, of the Convention. The support to the GCF, as well as the support to the GEF are also in line with the commitment to provide financial resources to meet the agreed full incremental costs of implementing measures that are covered by paragraph 1 of Article 4, and that are agreed between a developing country Party and an operating entity of the Financial Mechanism, referred to in Article 11 of the Convention.

So, these are the new and additional financial resources that have been provided by Belgium pursuant to Article 4, paragraph 3, of the Convention.

The new concept of "new and additional"

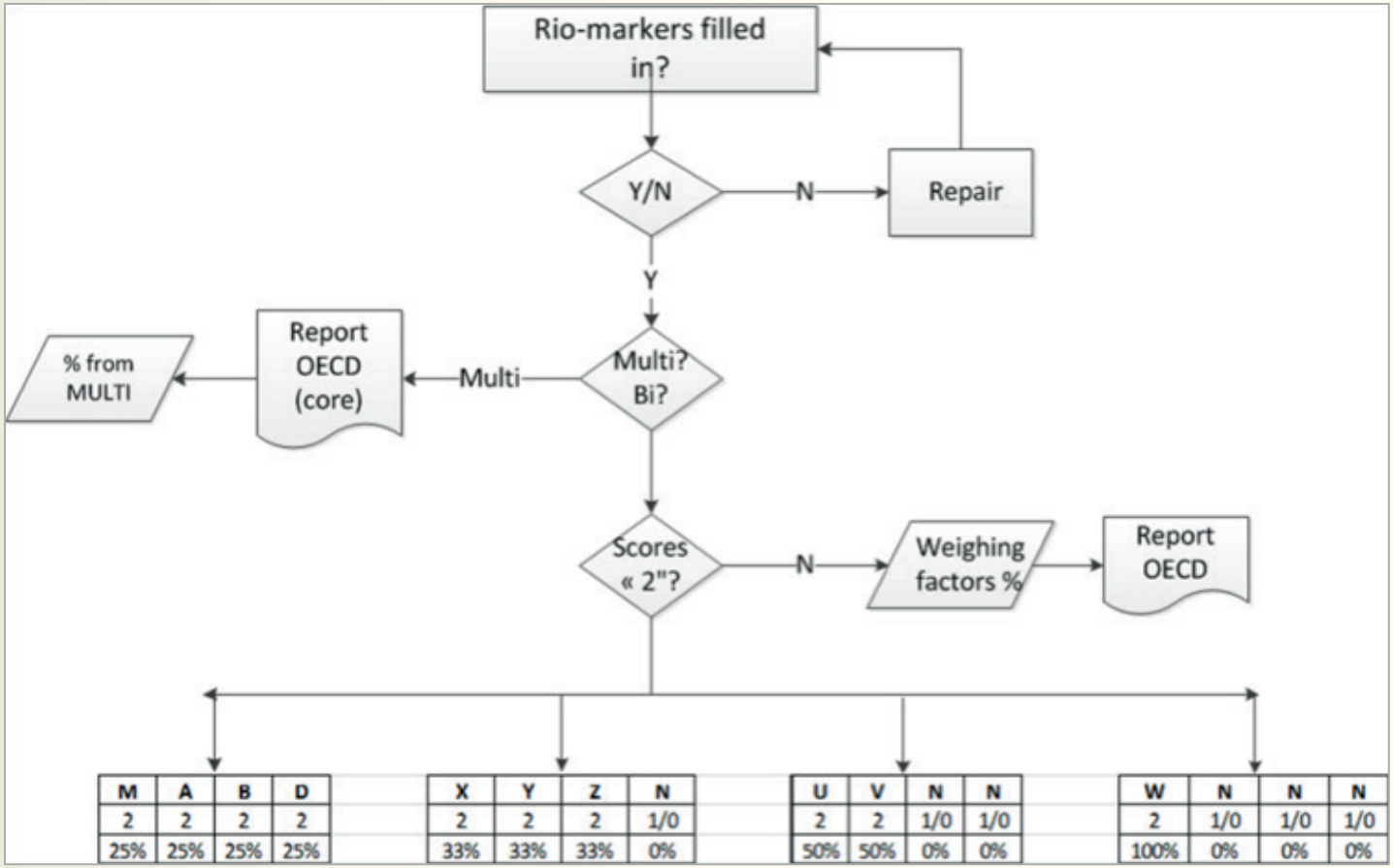
Both the financial architecture as well the commitments by Parties have changed significantly since the Convention. Financial support to climate action in developing countries does not only flow through the operating entities of the Financial Mechanism.

Belgium does not agree with a clear separation of climate finance from development finance as climate and development assistance are strongly interdependent and, as climate is mainstreamed in development finance.

Belgium strives towards full transparency of its use of reporting methodologies, to ensure that the origin of the support is clear. Given the absence of an internationally agreed definition, its financial support is described as new and additional as it contains:

– Provisions in line with Article 4, paragraph 3, of the Convention (123.8 million EUR to GEF and its climate funds; 71.7 million EUR to GCF);

Figure 7.9: Federal methodology for finance reporting



M	A	B	D
2	2	2	2
25%	25%	25%	25%

X	Y	Z	N
2	2	2	1/0
33%	33%	33%	0%

U	V	N	N
2	2	1/0	1/0
50%	50%	0%	0%

W	N	N	N
2	1/0	1/0	1/0
100%	0%	0%	0%

- Contributions which would not have existed without the financial commitments resulting from the Copenhagen Accord (150.5 million EUR during the reporting period);
- Budget lines on top of the annual budget for bilateral development cooperation;
- Only the climate-specific or climate-relevant part of projects and programmes. Based on our methodology (see Figure 7.9), Belgium does not report the full amount of the projects/programmes if these are only partly relevant to climate action (170.3 million EUR in reporting period);
- Only climate-related projects in developing countries, additional to the previous reporting period (332.2 million EUR in reporting period);
- Contributions coming from the auctioning proceeds of greenhouse gas emission allowances. ■

8. Research and systematic observation

8.1 General policy on research funding

8.1.1. Changes since 2013

As explained in more detail in the previous national communication, institutionally speaking, Belgium is a type of 'mini-Europe', where each of the federal and federated state authorities (Regions and Communities) is singularly competent for the areas of science, technology and innovation (STI) granted to it by law. The long decentralisation process which began in the 1970s, has led to a fascinating differentiation of institutions and policies adapted to the specific STI potential and the social and economic needs of each part of Belgium and its different entities (BRISTI, 2010)[1]. The RIO Country Report (2016)[2] offers a recent analysis of the R&I system in Belgium with particular focus on topics critical for EU policies.

Compared to the latest national communication (2013) some major changes occurred in the Belgian science policy landscape.

In view of improving the efficiency of the science policy at federal level and an optimal utilization of federal budgets, an ambitious reform of federal science policy was launched in 2014 (see Federal government policy agreement, 2014). The alignment between the various policy levels will be refined and strengthened and cooperation between federal scientific institutions and universities will also be strengthened and if possible structurally expanded.

Federal governmental departments, including the PPS Science Policy and the federal scientific institutions are involved in an on-going restructuring aiming to optimise the use of available resources. The federal scientific institutions (FSI), so far dependent on the PPS science policy, include the Royal Meteorological Institute (RMI), the Belgian Institute of Space Aeronomy (BISA), the Royal Museum of Central Africa (RMCA) and the Royal Belgian Institute for Natural Sciences (RISNB), which have to a greater or lesser extent climate-related research in their portfolio, are becoming more autonomous. They will participate in a process of upscaling and networking, without losing sight of their own specificities. The main objective of the attribution of a higher degree of autonomy to these institutions is to make them more effective.

A new inter-federal space agency is being created allowing intra-Belgian coordination, especially in the context of ESA (the federal level is competent for space re-

[1] *Belgian Report on Science, Technology and Innovation* (BRISTI).

[2] Kelchtermans, S, Robledo Böttcher, N; *RIO Country Report 2016: Belgium*; 28498 EN; doi: 10.2760/273083.

search in the framework of international or supranational institutions and agreements or acts; the Regions have competences on innovation in the context of their economic policies).

There are two major innovations for the federal research programmes. Through the FED-tWIN program, 125 research functions will be awarded in the next seven years (2015-2022) with a view to foster sustainable cooperation between universities and FSIs. In addition, the BRAIN program will also be renewed, with an eye for both continuity and substantive renewal. The members of the Government will select research themes related to federal policy needs. The budget (94,3 MEUR for the period 2018-2028) for the BRAIN programme will decrease by 20% due to budget cuts.

In Flanders, the policy domain of Economy, Science and Innovation of the Flemish Government was simplified in 2016. It now consists of the Department of Economy, Science and Innovation (Dept. EWI), the Agency Flanders Innovation & Entrepreneurship (VLAIO) - a one-stop shop for all R&D funding for companies- and the Research Foundation – Flanders (FWO) funding research in universities and other regional research institutions. The general R&D&I system of Flanders is described in 'STI in Flanders': Science, Technology & Innovation. Policy & Key Figures – 2016.

Over the last 25 years, the overall funding for R&D&I in Belgium has shifted from the federal level to the regional level; the Flanders Region alone is now responsible for about half of this funding (see Table 8.1).

The research and innovation policy of the Brussels Capital Region (BCR) is governed by the latest Regional Innovation Plan (PRI), which was adopted by the Government of the BCR in July 2016 and runs until 2020. It describes the three smart specialisation priorities of the BCR, among which 'the environment' and 'the green economy': the choice of priorities was made on the basis of an entrepreneurial discovery process through consultations with all relevant stakeholders. The 'green economy' strategic priority connects to the Regional Circular Economy Plan (PREC) and the smart city strategy aiming at improving the quality of life of citizens in an urban environment. The main fields of innovation are: energy efficiency, sustainable chemistry, circular economy and mobility, which all have an impact on CO_2 emissions.

8.1.2 Coordination between the Regions, Communities and the federal level

Cooperation, coordination and consultation, which form the basis for the formulation of decisions and positions related to research policy, are organised by the International Cooperation Commission (ICC) and the Federal Cooperation Commission (FCC), two permanent committees of the inter-ministerial Conference for Science Policy (IMCSP).

8.1.3 The open data policy

The federal government agreement (October, 2014) promotes an open data policy, with an enhanced access to public data. Public services make available to citizens, researchers, companies and governments the information that they have in the context of their assignments for reuse. This is not only about providing government data, but also about building a community around the use of these data. Companies

The CIS has different thematic subgroups. The CIS-climate for example identifies the Belgian positions and prepares input to H2020 SC5. The CIS-IPCC, an ad-hoc group of CIS-climate, prepares the Belgian positions and contributions for the IPCC.

Table 8.1: Investment in R&D in KEUR at current prices (without R&D fiscality) adapted from the Overview of the government budget appropriations or outlays for R&D (GBAORD) in Belgium in the period 1989-2016. For the years 1989 to 2015, the overview is based on the final budget figures, and for 2016, on the initial budget figures (i)

Public authorities	1990	2000	2010	2013	2014	2015	2016 (i)
Federal	370 537	476 225	563 458	601 232	601 447	560 635	557 799
Flanders	255 357	595 684	1 224 024	1 243 501	1 397 775	128 426	1 398 235
French community	166 059	210 819	290 091	309 345	314 843	319 489	329 638
Wallonia	39 443	132 597	263 577	338 569	379 636	324 536	226 302
Brussels	14 588	7 903	33 896	29 812	34 441	34 248	43 688
Total	**845 985**	**1 423 228**	**2 375 046**	**2 522 459**	**2 728142**	**255 661**	**2 555 661**

and institutions can process and further enrich with their own information to market new products and services. This initiative can be important in the development of climate services.

Opportunities for free and open exchange of data and information consist of three distinctive fields:

- all the data and information generated by public institutions, such as meteorological measurements, which can feed scientific analysis;
- data which accompany and underpin specific scientific publications and which should be documented in a way that allows for experimental replication;
- scientific publications themselves.

Three types of data and information are subject to different dissemination rules and communication channels. The European Directive 2013/37/EU on the re-use of public sector information, which was subsequently converted into Belgian law, enables open access to information distilled by public institutions, such as meteorological measurements. Belgium is currently considering to act upon the EC's July 17, 2012 Recommendation. Open Access to research publications is officially required in all universities which also all harbour Open Access compatible digital repositories. A central repository of this kind has been created at the Federal level, serving 11 research institutions so far.

8.2 International activities

Climate-related research is a typical field for international cooperation. Our national climate research fits seamlessly with the European and international strategies. BELSPO and the FSI participate in Copernicus. With this programme, the European Union wants to set up operational services in Europe to create useful services to enhance access to environmental data and information. In addition, Belgian science policy institutions and funding agencies are also involved in European joint programming initiatives (JPIs). JPIs (JPI Climate, Water JPI, JPI Oceans…) that constitute an efficient strategy for transnational collaboration and multi-annual programming at variable geometry and with newly developed and tested portfolio of actions and tools for transnational collaboration. Challenges relevant to more than one JPI, such as climate change, form a basis for specific consultation between these JPIs so that the impact of research funding is maximised at the EU scale.

Belgium takes an active part in developing climate-relevant distributed research infrastructures, such as ICOS (Flanders, BELSPO, WAlloon Region), ANAEE (Flanders, BELSPO), and LifeWatch (Flanders, BELSPO).

In the framework of H2020, BELSPO has set up a Coordination and support action (CSA) on 'Widening international cooperation activities on climate adaptation and mitigation" (SINCERE). This CSA will a.o. develop two Flagship Actions, focused on the design of research and innovation collaborations in Africa and Latin America, for expanding and deepening knowledge to support climate change adaptation and mitigation.

BELSPO, as a funding agency, and RMI as a research performing agency, participated at the ERAC4CS (ERA for climate Services). In total 5 projects are funded (2 cash via BELSPO and 3 in kind via RMI).

The Belgian Biodiversity platform, an initiative of BELSPO, is a key player in promoting research in support to the Nature Based Solution concept at the local, national, European and international level. Nature based solutions refer to the sustainable management and use of nature for tackling societal challenges such as climate change. e.g.: EKLIPSE MECHANISM.

By its contribution to sequential calls launched by BiodivERsA (ERA-net on biodiversity and ecosystem services), BELSPO was able to fund several projects dealing with biodiversity dynamics in the face of climate change (eg SIGNAL, CLIMARCTIC).

The ERA-NET CIRCLE2 on Climate Impact Research & Response Coordination for a Larger Europe ended on 30 April 2014 and an overview of climate adaptation research at national level was published afterwards.

As concerns cooperation on a global level, the JPI Climate cooperates closely with the Belmont forum in view of launching joint calls.

On the International level, BELSPO has tools for multilateral and bilateral cooperation.

In the framework of a bilateral agreement with China, a call was launched in 2016 focusing on the role of oceans in the climate system and resulted in one project: OCEANIC.

In the framework of a bilateral agreement with Vietnam, BELSPO plans a call for 2019 focussing on Climate and Disaster resilience.

A call for Joint Research Networking Proposals with South-Africa is being launched in June 2017, with as thematic foci 'marine sciences' and 'space'. Climate related topics are (among others) of common interest. Project execution will be from 2018-2020.

BELSPO participated in the Network of the European Union, Latin America and the Caribbean Countries on Joint Innovation and Research Activities (ERANet-

LAC). One selected project with a Belgian participation, covering various European and Latin American ecozones and relating to Collective Response from Individual Behaviour in Groups and Ecosystems 'CRIB' is ongoing (2017-2019).

The IPCC provides policymakers with sound climate science. Some Belgian experts are selected to contribute to the 6th Assessment which allows them to integrate and assess their expertise in a broader context.

The participation of Belgian scientists in the activities of the Intergovernmental Panel on Climate Change (IPCC) and the dissemination of its assessments are key elements in contributing to the understanding of challenges and the implementation of solutions to climate change. BELSPO supports the IPCC in particular by acting as IPCC Focal Point, by paying an annual contribution to the trust fund, by funding the scientific and technical support team of the IPCC Vice chair during its mandate in the fifth assessment cycle as well as by the funding of authors and reviewers in the previous assessments and probably also for the next assessment, and by coordinating the CIS-IPCC, a concertation group that prepares the Belgian view points for IPCC activities.

More specifically, in order to facilitate the interactions between Walloon and other francophone scientists, stakeholders, citizens and decision makers, the Walloon Government created the "Walloon Platform for the IPCC", under the responsibility of Professor Jean-Pascal van Ypersele (Université catholique de Louvain, Louvain-la-Neuve). The activities of the Platform include: scientific monitoring (analysis of new scientific publications related to climate change); information to decision-makers (publication of a regular Letter, briefings, response to requests for information, participation in conferences); coordination of the work of reviewing IPCC reports by francophone experts; participation in outreach and representation abroad in relation with scientific activities related to the work of the platform; and support to the committee of experts of the Walloon climate decree. The Platform collaborates with the Walloon Air and Climate Agency (AWAC) and works in a complementary way with the Belgian IPCC focal point. One of the specific tasks of the Platform is to create and maintain a register of francophone experts in Belgium on all dimensions of climate change[3].

Flanders participates in a number of coordination and funding mechanisms in the context of the European Research Area (ERA). The specific list of participations is currently (2017) under review by VLAIO but current relevant participations are e.g. those in the sphere of renewable energy: 'ERA-net Smart Grids Plus' and 'ERA-net Demo Wind' (offshore wind energy).

The subject of optimal use of water (in an adaptation context) is covered e.g. by the ERA-Net WaterWorks2015 on "sustainable water use in agriculture, to increase water use efficiency and reduce soil and water pollution". There is a continuous roll-over of collaborative funding mechanisms relating to EU water research. Previous Water-related ERA-NETs: CRUE (completed in 2009), IWRM NET (completed as an ERA-NET in 2010, with the network continuing operations), and SPLASH (completed in 2011), WaterWorks2014 (ongoing, to be completed in 2019).

Related on-going ERA-NETs: BiodivERsA (related through the area of green infrastructure, and possibly future collaboration); CIRCLE2 (related through floods and droughts).

European Technology Platforms (ETPs): The most directly related ETP is the Water Supply and Sanitation Technology Platform (WssTP).

European Innovation Partnership on Water (EIP on Water): An initiative within the EU 2020 Innovation Union. Eight priority areas have been chosen for the EIP Water, six of which are particularly relevant to the scope of WaterWorks2015: water reuse and recycling, water and wastewater treatment including recovery of resources, water-energy nexus, flood and drought risk management, water governance and decision support systems and monitoring.

Flanders together with its Strategic Research Centre VITO (Flemish Institute for Technological Research), is a member of the BERA (Belgian Energy Research Alliance) and is involved in various EERA Joint Programmes. In addition to this, Flanders is significantly enrolled in the Strategic Energy Technology Plan (SET Plan), which is a pioneer in terms of an efficiently coordinated approach for all European countries in the field of energy technology.

Since 2015, Brussels Environment is leading the EU funded project (H2020) "Buildings as Material Banks" (BAMB2020). This project brings together 15 partners from 7 European countries for one mission – enabling a systemic shift in the building sector by creating circular solutions. The project is developing and integrating tools that will enable this shift: Materials Passports and Reversible Building Design – supported by new business models, policy propositions and management and decision-making models. These tools support the building sector to take action for the climate. Reversible building design makes buildings adaptable and resilient. Embedded energy in building products, from harvesting of raw materials, production, transport etc., is a big part of a buildings' energy consumption.

[3] Contact: register@plateforme-wallonne-giec.be

8.3 Domestic research actions and relevant activities

Within Belgium there is no single climate research programme, nor on the federal level, nor on the regional level. However there are several funding instruments which could fund climate related research.

The Belgian universities are engaged in many areas of climate science. Although only a few of them have developed a climate science department, most of them have world-class research in related areas. A limited number of universities are engaged in observation and monitoring activities in the context of research infrastructure. The Université de Liège for example is engaged in long-term monitoring of the atmospheric composition (CO_2, Methane etc.) at the Jungfraujoch scientific station in Switzerland. Observation facilities within the GCOS or ICOS frameworks respectively are also operated by academic institutions, for example, at Université de Liège, the Royal Military Academy and Universiteit Hasselt (see Section 8.4). However, most of the Belgian universities are using observational data provided by RMI or global data sources based on observations from other large institutions abroad.

The main activities in support of climate research are modelling and model development. The strengths identified in Belgian universities on physical aspects include climate modelling, atmospheric chemistry, biogeochemical cycles and ecosystems, cryosphere (polar, mountainous, glaciers), hydrosphere and oceans, and paleoclimate. This includes the operation of, e.g., vegetation models, ecosystem models, hydrological models etc. Besides these physical aspects of climate and climate change impacts, the social science dimension contributes with climate governance studies and economic impact studies (which also includes modelling). In spite of the great potential, the activities around socio-economic sciences are less developed and less supported than the more traditional climate-related research activities based on natural sciences.

Besides these research fields, there is additional expertise available at Belgian universities that is related to climate and climate change. These include topics such as energy efficiency and renewable energies, technological aspects focusing on solutions to the climate problem (low carbon materials, urban issues, local environmental management). Communication on climate and climate change issues is also covered.

Most of the universities have been or are currently engaged in international and European research projects and initiatives or infrastructure projects (FP7 - 7th Framework Programme), Horizon 2020 projects and COST (European Cooperation in Science and Technology) actions). Activities related to observation and monitoring includes participation of some universities in networks such as GCOS, ICOS, ESA and EUMETSAT. On the national level, networking with regional public services, local authorities as well as with the private sector has been developed. The Flemish government is attributing additional funding for research to underpin improved coastal flooding defence taking account of medium-term projections of storminess and sea-level rise (project 'Vlaamse Baaien'.

Some universities have bundled their climate related activities from different faculties or departments in specific 'topic centres'. Among them are the Leuven Sustainable Earth Research Center (LSUE) at KU Leuven, which covers a portfolio even broader than climate, and the George Lemaître Center for Earth and Climate Research (TECLIM) at UCL, which is part of the overarching and broader Earth and Life Institute. A few areas related for example to health issues, to the agricultural sector and to the critical sectors of infrastructures, urban or spatial planning is still not fully covered, and deserves attention in the development of future activities.

While fundamental research is primarily conducted at the FSI and the universities, several initiatives focusing on the provision and dissemination of climate-related information have been initiated and are supported by the regional governments. An example is provided in Wallonia by the Agence Wallonne de l'Air et du Climat (AWAC) that provides climate information to users and has led the development of a climate adaptation plan for the region. In Flanders, VITO is conducting applied research on environmental issues and is in the process of developing a regional climate service center. The products developed by these regional institutions are of high quality and of high relevance.

The regional climate services are ideally placed to provide regionalized data and information in support of regional and local policy-making (e.g. adaptation or spatial planning), to monitor climate policies and to measure the performance of impact and vulnerability studies. Regional government agencies like AWAC, technological research centres like VITO, as well as some private or international research organizations like the Von Karman Institute (VKI), involved in applied geophysical fluid dynamics and climate research, have entrepreneurial expertise in "selling" services tailored to specific users. (Brasseur et al, 2015).

Five of the FSI which fall under Belgian Science Policy are engaged in climate related research activities: the Royal Belgian Institute of Natural Sciences (RBINS), the Royal Meteorological Institute (RMI), the Belgian Institute for Space Aeronomy (BISA), the Royal Museum for Central

Africa (RMCA) and the Royal Observatory of Belgium (ROB). None of these institutions have climate research as their primary mission. However, their fields of activity are often related to climate and climate change. This is particularly the case of the RMI, in which climate research is mentioned as an assignment and although the RMI focuses on short-term weather analysis and forecasting, the institution has an extensive experience in the field of climatological data analysis. The BISA is involved in space observations of the Earth and as such provides important information on the climate system. The other FSI (ROB, RMCA and RBINS) provide additional information of great relevance to climate science (e.g. solar variability, biodiversity, biological evolution, etc.). Finally, the already existing cooperation between the FSI and different universities offers opportunities for future activities (Brasseur et al., 2015).

8.3.1 Federal level - BELSPO

The majority of climate research conducted by the Federal Government is integrated within the framework of the Belgian Research Action through Interdisciplinary Networks (BRAIN-BE (2011-2018) and to a lesser extent in STEREO III (Earth observation by satellite research programme, 2014-2020).

The ongoing BRAIN programme, through the funding of research projects based on scientific excellence and European and international anchorage, allows to meet the needs for scientific knowledge of the federal departments and to support the scientific potential of the Federal Scientific Institutions. The selection of projects is based on calls and evaluations. The resulting projects can be consulted. A second phase of BRAIN will be launched in 2018. It is proposed that the climate related research will focus on the scientific support to the implementation of the Paris agreements (including negative emissions and the support to climate services).

BELSPO launched its first Belgian research program for earth observation in 1985. It continues at present as STEREO III. One of the objectives of STEREO III is to study the interaction between changes in land use and climate change. Satellites are the most appropriate tools to monitor global interactions between oceans, continents and the atmosphere. Other thematic projects focus on the impact of climate change on a wide range of domains: food safety, marine environment, risk management, health problems, biodiversity, cultural heritage, etc.

The final results of climate related activities in the former research programme 'Science for a Sustainable development (SSD), including the climate related projects, are published in a brochure.

In 2015, the BELSPO magazine 'Science connection' highlighted ongoing climate related research in Belgium. A brand new instrument called FED-tWIN is under development. The FED-tWIN programme was approved by the Council of Ministers on November 2016. It is aiming at "sustainable cooperation in research between federal scientific institutions and universities". Postdoctoral researchers will be re-recruited for a long term (10 years) and will respond to job profiles and research needs defined by a Belgian university and a FSI. The FED-tWIN programme is complementary to the BRAIN-BE program that finances research projects of 1, 2 or 4 years. This new program allows various research themes (long-term basic research rather than 'policy-supporting' research) to become part of FED-tWIN in the future. With this instrument it is possible to fund long term climate related research.

The 6th national communication mentioned a feasibility study for a Belgian Center of Excellence on Climate. The national adaptation plan (April 2017) proposes to develop a roadmap for a Belgian excellence Centre for Climate. A feasibility study has been performed to this effect by foreign experts. The study was finalised in 2015 but has not yet been published. Research necessary to develop climate services, such as the development of regional models (CORDEX-BE) and impact studies (ERA4CS), is further pursued.

The expertise platform on climate scenarios, set up in 2013, directs the development of coherent climate scenarios and a forwardlooking approach as regards the scenario and model development needs in the future. The platform is funded through BRAIN (CORDEX-BE). This important development paves the way for the development of climate services.

Other federal FPSs

In the context of development cooperation, a university research platform has been set up ('Klimos') to provide policy support on climate change. This includes the development of an 'Environmental Sustainability Tool Kit'. In addition to various bilateral programmes and multilateral organisations devoted to climate adaptation, Belgium supports international scientific research into climate adaptation and agriculture, notably via the 'Consultative Group on International Agricultural Research' (CGIAR).

8.3.2 Regions and Communities

At the regional & community level, there are no specific 'thematic' research programmes, the main funding through the agencies FNRS and FWO is competitive and based on the principle of 'excellence'. Information on projects funded through these funding organisations can be searched:

– in Flanders through the FRIS portal. Although this portal allows metadata searches, it was not possible to do a meta-analysis or synthesis of the most climate-relevant on-going research projects.
– in Brussels through several research & innovation programmes managed by Innoviris.

Flanders

Most climate research in Flanders takes place in universities and research institutes. In addition to this, various Flemish research centres conduct climate research: the Flemish Information Centre for Agriculture and Horticulture (VILT) for agriculture, the Institute for Nature and Forest Research (INBO) for forestry, and the Institute for Agricultural and Fisheries Research (ILVO) for fisheries and agriculture. The study by VITO (Flemish Institute for Technological Research) concentrates on innovative technology that supports the transition to a more sustainable industry.

Although the Flemish science and innovation policy is based on a bottom-up approach, there are also thematic priorities identified by the Government. In its Vision 2050, the Flanders government selected seven transition priorities: circular economy, smart living, Industry 4.0, Lifelong learning and a dynamic professional career, healthcare and welfare, transport and mobility and energy.

Brussels-Capital Region (BCR)

Among the different research programmes managed by INNOVIRIS, the main contributions to climate research are found under the thematic ANTICIPATE, BRIDGE and CO-CREATE schemes, as well as under the bottom-up industrial research schemes and the European P2P schemes in which INNOVIRIS participates.

The ANTICIPATE scheme funds projects by academic researchers at research institutions in the BCR with a future-oriented vision, in areas that are of political importance to the BCR. The projects contribute to the development of knowledge about the complex urban environment of Brussels. Projects in social sciences as well as natural sciences can be funded: all projects need to take the valorisation of research into account. Over the past years, climate-related call topics have been: urban and industrial ecology in the BCR, mobility in Brussels (2013 call), urban development and public cleanliness (2015 call), the residential function of Brussels and its dynamics (2016 call), health and environment and circular economy (2017 call).

The BRIDGE scheme funds strategic platforms, projects that emphasise results under the form of applications for the relevant economic sectors in Brussels. These projects should be collaborative and multidisciplinary and treat areas which are identified as priorities for the BCR. They plan valorisation in the short and mid-term. Topics are selected in accordance with Brussels' innovation trends, the real needs of the socio-economic stakeholders in the BCR and the availability of research groups. The BRIDGE scheme strongly encourages maximal collaboration in a consortium comprising more than one research group as well as industry, the non-profit or institutional sector, in order to foster the transfer of technology and knowledge. The 2015 call topic was energy autonomy and, specifically, energy harvesting, storage and management at the device and micro-grid levels.

The new CO-CREATE scheme, which was launched in 2016, aims to bring together the citizens of the BCR and the research and innovation and business sectors. The scheme funds projects in applied research and innovation that work within an interactive co-creation dynamic. Projects take place within "living labs" co-founded by researchers, economic actors and associations, where they work together with the end-users of the projects' results. The 2016 call topic was sustainable food systems; the 2017 call topic is urban resilience.

Beyond these thematic schemes, the open, bottom-up calls for industrial research and development projects run by INNOVIRIS also frequently fund climate-related projects, often in the areas of logistics or energy efficiency. Examples of project topics funded in this way are circular economy ecosystems in large industrial estates and business clusters, natural gas-fuelled vehicles, models to reduce the gaps between anticipated and actual energy consumption in buildings or optimised local energy production and storage.

Brussels Wallonia Federation

Strictly speaking, the Brussels Wallonia Federation doesn't fund thematic research programmes. Using the funds is entirely up to the institutions (FRS-FNRS and universities). Within the FRS-FNRS, research topics are differentiated by discipline and not by theme. Research about climatology and climate changes is mainly categorised under the headings "Earth Sciences" and "Natural sciences". In the field of climatology and climate changes, the FRS-FNRS funded 11 research projects in 2016: 4 offices of postdoctoral researchers, 5 grants for 4-year-long doctoral programmes, 2 research credits (funds provided to standing researchers to cover the operating expenses or equipment costs). In addition, currently 8 FRS-FNRS standing agents (out of 400) are active in the field of climatology. More widely, the FRS-FNRS has a scientific commission on sustainable development, namely the scientific FORESIGHT Commission. In 2016, the FRS-FNRS also organised the "FRFS-WISD" call to finance research projects in the field of sustainable development.

Walloon Region

In Wallonia, science, technology and innovation (STI) are managed by several directorates general of the Walloon Public

Service (SPW). The Walloon Region primarily finances research, development and innovation activities with a view to developing economic and industrial activities, as well as research aimed at developing specific expertise within its areas of competence. The Operational Directorate-General for the Economy, Employment and Research (DGO6) has primary responsibility for drafting and implementing policy, through its Competitiveness and Innovation, Technological Development and Research Programmes departments.

Other ministries also have responsibilities for financing research activities in their respective areas of competence. They are completely independent in developing such activities.

Other SPW operational directorates general manage smaller budgets and actions to support STI activities in their particular areas of competence: natural resources and the environment, social and health programmes, town and country planning, equipment and transport, energy efficiency, sustainable energy and buildings, etc.

Research participants are mainly companies, universities, higher education institutes, research centres and public research bodies.

For more information:

- Research in Wallonia;
- The environment in Wallonia;
- Energy in Wallonia.

8.4 Systematic observation

New developments concerning systematic climate observation in Belgium or by Belgian actors in the period 2013-2017.

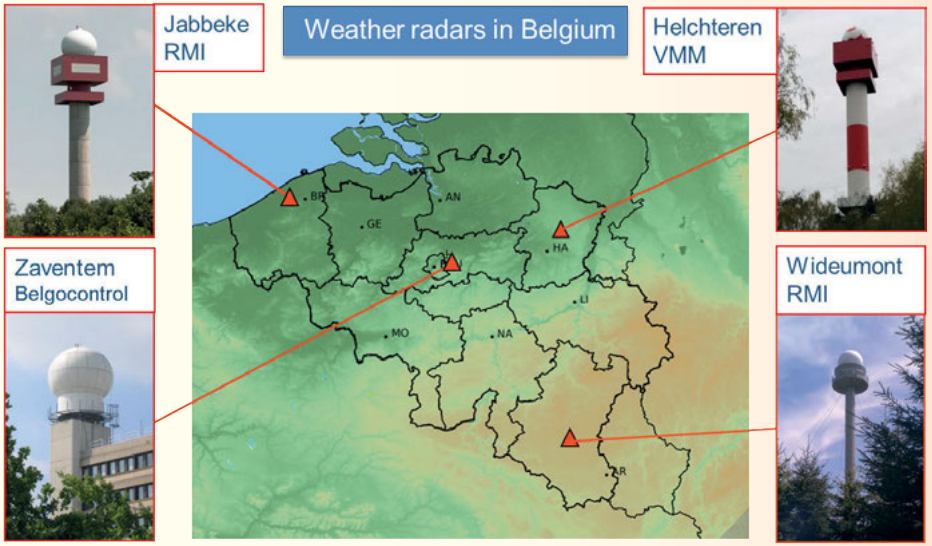
8.4.1 Climate atlas

The Royal Meteorological Institute of Belgium (RMIB) has developed a climate atlas of Belgium which integrates climate maps of Belgium for various meteorological parameters including air temperature, precipitation, solar radiation, lightning and the annual number of snow days. These maps represent the spatial distribution over Belgium of climate mean values that are related, when possible, to the reference period 1981–2010 in accordance with the recommendations of the World Meteorological Organization (WMO). This atlas has been published online in May 2015 (www.meteo.be/climatlas, www.meteo.be/klimaatlas).

All maps are derived from observations and result from a spatial interpolation method adapted to each meteorological parameter. Precipitation and air temperature climate maps rely on time series of daily observations from 1981 to 2010 made in climatological stations equipped with a rain gauge and a temperature shelter. In the case of solar radiation, high resolution maps are obtained thanks to the combination of observations from about 10 ground stations with data acquired by Meteosat satellites since 1984. Lightning climate maps are derived for the period 2004–2013 from the observations of the BElgian Lightning Location System (BELLS) which detects and locates all lightning activities in Belgium. Finally, climate maps related to the annual number of snow days rely on 1985–2014 time series of visual observations of the precipitation types made in manned synoptic stations.

The climate atlas is supplemented with climate sheets for each Belgian municipality summarizing the local climate by means of usual climate statistics (e.g., climate mean values, climatograms, wind roses, etc.).

Figure 8.1: Weather radars in Belgium



8.4.2 Ground based remote sensing for climate studies

Climate studies are generally based on long records of ground station measurements. However, a wealth of information can be additionally extracted from remote sensing observation systems even if the available time series are shorter. This is particularly true for local phenomena like intense precipitation, thunderstorms or hail, which are poorly captured by conventional ground station networks. For several years, RMI has been investigating how archived observations from the weather radars and the Belgian lightning detection system (BELLS) can be used to derive statistics on rainfall amounts, convective storms and hail falls. This research has shown the benefit of remote sensing observations for better characterizing the frequency, the severity and the diurnal and seasonal cycles of these high impact weather phenomena. A very careful data processing and quality control is required to obtain robust statistics that can be further used for risk analysis and the verification of climate models.

8.4.3 A new weather radar in Helchteren

The Flemish Environment Agency (VMM) is the operational water manager for the larger non-navigable water courses in Flanders. It operates a dense hydrological measurement network (+400 field sites: flow, stage, precipitation, evapotranspiration, soil moisture), a hydrological data management system, hydrological (forecast) models and reports on the hydrological status of the water system, flood- and drought events (www.waterinfo.be).

In 2016 the weather radar installation of Helchteren (BEHEL) in the eastern side of Flanders became operational and it provides data with a spatial resolution of 500x500m every 5 minutes. Data of the VMM precipitation (OTT) network of 43 rain gauges distributed over Flanders is processed per 5 minutes and used for the real time calibration of the radar images. (For further information: neerslagradar-in-cijfers; hoe-werkt-een-neerslagradar).

Radar data of the RMI radar in the western part of Flanders is mutually exchanged between the RMI (Royal Meteorological Institute Belgium) and the VMM. Recently this mutual exchange has started also with the KNMI in the Netherlands and the Helchteren radar will be integrated within the EUMETNET OPERA network.

The generated radar composite image covering Flanders provides detailed information for the hydrological data management system and also feeds the hydrological forecasting models. The local flood situation in Flanders can be monitored in near real time and the analyses for the precipitation natural hazards can be further optimized.

8.4.4 Lidar/ceilometer network

During the period 2013-2017, RMI completed the installation of its automatic LIDAR-ceilometer (ALC) network in Belgium. This network is composed of 4 ALCs (of the type CL51 VAISALA) located in its synoptic stations in Uccle, Zeebrugge, Humain and Diepenbeek. Each ALC operates up to 15 km with a vertical resolution of 10 m and a temporal resolution of 6 s. The ALC data are sampled every five minutes.

This new high sensitivity ALC network offers the opportunity to monitor the cloud base height, the early stage of radiation fog formation, the vertical profile of aerosols and the mixing layer height on a continuous temporal scale. It benefits for the aviation, for the forecaster's work (especially for the prediction of fog), for the monitoring of air pollution dispersion and for the monitoring of aerosol clouds such as volcanic ash clouds.

In the framework of the development of a coordinated system for ALC observation in Europe, RMIB is involved in two major European projects in view of making available the measurements of its future ALC network to the European meteorological community in near real time. Within EUMETNET, RMIB participates to the E-PROFILE program to develop an operational ALC network by the exchange of ALC data in a standard format and the maintenance of an archive of communicated data and metadata for all systems connected to the network. RMIB also participates in a COST Action: TOPROF. The aim of this action is to coordinate the operation of many ALC installed across Europe, so that they can be networked and provide quality controlled and calibrated observations of aerosols in the lowest few kilometres of the atmosphere to the national meteorological service in near real time.

8.4.5 Ground-based Global Navigation Satellite System network

Water vapour is the most important greenhouse gas as it contributes for about 60 % of the natural greenhouse effect. It also provides the largest known feedback mechanism for amplifying climate change (e.g. doubling the warming due to increasing CO_2 concentrations alone). Measuring this essential climate variable (ECV) is hence important, but not straightforward, as it has a very high temporal and spatial variability. In recent years, the use of Global Navigation Satellite System (GNSS) networks to sense water vapour in the troposphere has increased. In addition to its application for geodetic positioning, it also allows the estimation of the total column amount of water vapour from the propagation delay of electromagnetic waves it causes in the atmosphere. Recently, a reprocessing of the historical archive of about 280 European permanent reference GNSS stations (see right plot, more info on http://www.epncb.oma.be/) has been undertaken, so that homogeneity in the data processing for the time period 1996-2014 is guaranteed, and the time series of total column water vapour can be used for climate applications. In the Belgian territory, six GNSS stations belonging to this reprocessed network are available.

The time series of these stations will be further homogenized by using statistical tools for breakpoint identification, in combination with the existing metadata information for those sites. Furthermore, the total column water vapour data will be compared with data retrieved from other techniques (e.g. radiosondes, UV/VIS and IR sensing by satellites) and from total column water vapour output from Numerical Weather Prediction model climate runs.

8.4.6 Proba V satellite

The Vegetation-1 and Vegetation-2 instruments on board the SPOT 4 and SPOT 5 satellites have been operational between April 1998 and 31 May 2014. These instruments have provided daily monitoring of the worldwide vegetation for more than 16 years, thus providing essential information on crop yields, droughts, desertification, climate change, changes in the type of vegetation, deforestation, etc. to a broad user community. The entire archive is being hosted by VITO and is freely available to the research community and other end-users.

ESA is currently launching the Sentinel-3 satellites, of which the first one (Sentinel-3A) was launched on February 16, 2016. The Sentinel missions are developed for the operational needs in land, ocean, climate change and atmospheric monitoring within the European Copernicus programme. However, between the end-of-life of SPOT-VGT and the launch of the Sentinel-3 satellites, a rather large time gap of about 3 years would occur, which would imply a discontinuation of the vegetation monitoring time series.

In order to preserve this observational continuity, Belgium decided to build a small satellite mission based on the successful ESA PROBA expertise using state-of-the-art-technology. PROBA-V (with "V" standing for Vegetation) was designed by a full Belgian consortium, fulfils all of the vegetation user's specifications and is complementary to the Sentinel-3 and Sentinel-2 satellites. The PROBA-V satellite was successfully launched in May 2013.

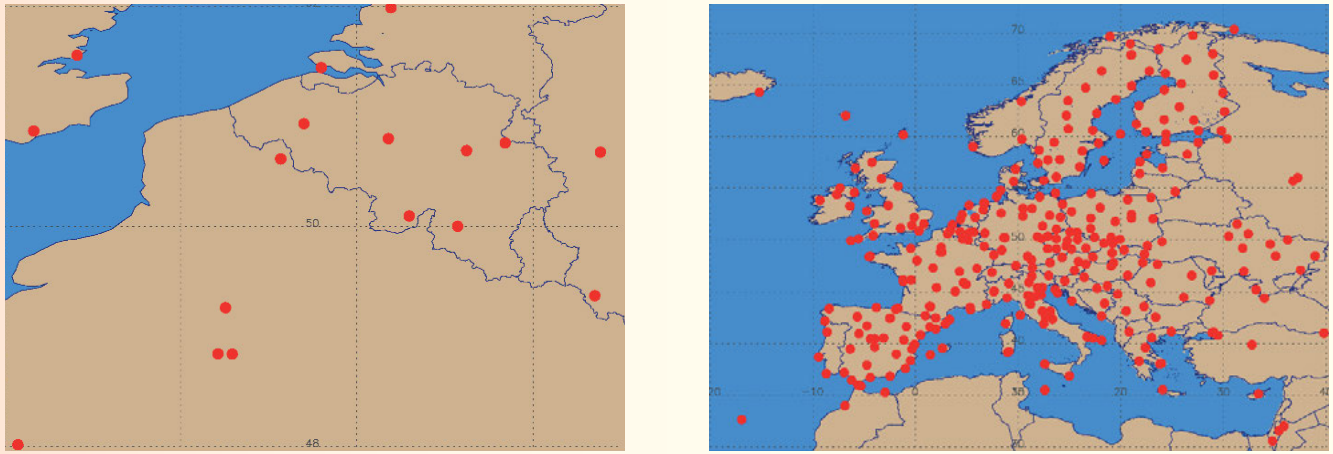
PROBA-V has a constellation of 3 cameras that observe the land surface and vegetation daily at similar spectral wavelengths (BLUE, RED, NIR, and SWIR) as SPOT-VGT, but with an improved spatial resolution (300 m and 100 m for the centre camera). These observations are processed into daily and 10-daily syntheses products, available at 100 m, 300 m, and 1 km. The products can be downloaded from http://www.vito-eodata.be.

In the meantime the PROBA-V user base has been growing steadily since its launch in May 2013, with up to more than 1000 active users on a daily basis. This user base is mainly situated in Europe but reaches nearly 110 different nationalities and 900+ institutions and companies worldwide.

More information can be found using the following links:

http://proba-v.vgt.vito.be/
http://www.vito-eodata.be/
https://proba-v-mep.esa.int/

Figure 8.2: Locations of GNSS stations in Belgium (left) and Europe (right), belonging to a network with homogeneous reprocessed data available for the time period 1996-2014



8.4.7 Climate SAF satellite products: Earth Radiation Budget & Aerosols

The goal of the Eumetsat Climate Satellite Application Facility (SAF) is to derive long term homogeneous Climate Data Records (CDRs) from satellite observations. The Royal Meteorological Institute of Belgium is a partner within the Climate SAF. In the period extending from 2012 to 2017, the RMIB derived two new CDR products from the European geostationary weather satellite Meteosat:

1) the estimate of the radiative energy fluxes leaving the top of the earth's atmosphere for the time period from to 2017.
2) an estimate of the Aerosol Optical Depth.

8.4.8 CO_2 monitoring

The Integrated Carbon Observation System (ICOS) is a monitoring network of the European Strategy Forum on Research Infrastructure (ESFRI) and was developed between 2009 and 2015. ICOS monitors the global cycle of both carbon and greenhouse gases across the European continent. ICOS integrates long-term and continuous greenhouse gas observations in three *in situ* networks (atmosphere, ecosystem and ocean).

ICOS Belgium is involved in these three observation networks.

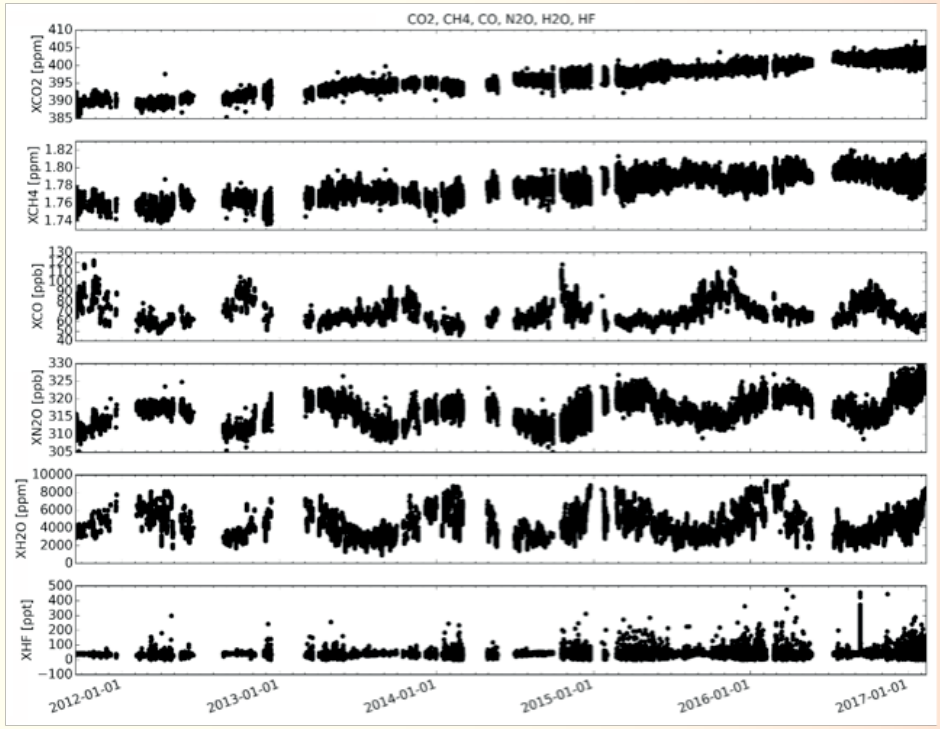
- **The ecosystem stations** measure fluxes of CO_2, CH_4, N_2O, H_2O and energy using eddy covariance, and fluxes of CO_2 from the soil with automated chambers. Soil properties and meteorological data are recorded at high frequency and complemented with additional vegetation information. There are six ecosystem stations in Belgium.
  - Three ecosystem stations (i.e. Brasschaat, Lochristi, Maasmechelen) in Flanders, hosted by the University of Antwerp.
  - Three ecosystem stations (i.e. Vielsalm, La Robinette, Lonzée) in Wallonia, hosted by the University of Liège (ULG)-Gembloux.
- **The ocean stations** monitor the carbon exchange between the sea surface and the atmosphere as well as surface temperature, salinity, dissolved CO_2 and chlorophyll. Belgium is hosting three ocean stations.
  - Two ocean stations (i.e. RV Simon Stevin and Thornton data buoy) hosted by the Flanders Marine Institute (VLIZ).
  - One ocean station (i.e. RV Belgica) hosted by the Royal Belgian Institute of Natural Sciences (KBIN).
- **The atmospheric stations** measure the concentrations of CO_2, CH_4, CO and radiocarbon-CO_2 in the atmosphere due to regional and global fluxes. One atmospheric station (i.e. Ile de La Réunion) is hosted by the Royal Belgian Institute for Space Aeronomy (BIRA).

The ecosystem stations of Brasschaat (Scots pine forest stand) and Vielsalm (mixed forest) are two of the longest running and most complete flux monitoring stations in the world.

Relevant websites: http://www.icos-belgium.be; http://www.icos-ri.eu.

The global distribution and strengths of the sources and sinks of GHGs are currently inferred from in-situ and remote sensing measurements made from ground based, airborne and spaceborne experiments in combination with modelling. The current reference ground based network providing total column GHG data is the Total Carbon

Figure 8.3: Time series of climate relevant gases measured by the Belgian TCCON experiment at Ile de La Réunion



Column Observing Network (TCCON). TCCON was established in 2004 with only a few stations, currently it is a network of about 23 globally distributed stations measuring precise and accurate total column abundances of CO_2, CH_4, nitrous oxide (N_2O), hydrogen fluoride (HF), carbon monoxide (CO), water vapour (H_2O) and heavy water (HDO) using Fourier-transform infrared solar absorption spectrometers. The TCCON data enable the detection of temporal drifts and spatial biases in the satellite data. They are also used for atmospheric model evaluation and in inverse modelling studies to better understand and predict changes in the current carbon cycle. The long-term goal is to improve our fundamental understanding of the impact of changes in both our climate and the environment in order to predict future conditions and to design mitigation and adaptation policies.

8.4.9 Global monitoring of atmospheric methane

CH_4 is a challenging atmospheric component to study as its non-monotonous changes in the last decades and its inter-annual variability remain not fully understood [4]. Methane concentrations have more than doubled since the pre-industrial period and are now approaching the most greenhouse gas-intensive scenarios [5]. Global monitoring of CH_4 is therefore essential to study the evolution of atmospheric CH_4 and to help increase our knowledge on how the different sources and sinks influence the atmospheric abundance of CH_4. Satellite remote sensing with thermal infrared sounders provides a great opportunity for studying the atmospheric composition on a fine spatio-temporal scale, during day and night, over land and oceans.

At the Royal Belgian Institute for Space Aeronomy (BIRA-IASB), a high-quality dataset of global CH_4 concentrations has been derived from measurements from the thermal infrared IASI (Infrared Atmospheric Sounding Interferometer) instrument on board the METOP satellite. The METOP/IASI satellite sounder, launched in October 2006, is the first in a series of subsequent satellites which will guarantee a continuous stream of high-quality data for climate monitoring until at least 2024.

One of our next objectives is to explore this dataset to help improve our understanding of the CH_4 budget. This task will be performed by a BELSPO financed pioneer project lead by BIRA-IASB in collaboration with the University of Liège. In this project, we will study the CH_4 source allocation with the GEOS-Chem chemical transport model, in combination with the IASI CH_4 data and ground-based measurements of CH_4 and its isotopologues. Better understanding of the CH_4 budget will help to target the pertinent sources for reducing CH_4 emissions and the associated climate impact of this greenhouse gas. ■

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9. Public awareness, education and training

9.1 Introduction

This Chapter reports on the actions taken in Belgium to raise public awareness of climate change, and on education and training relating to this issue. It presents essentially the activities organised or financed by the public sector, but also actions undertaken by certain organisations of civil society or the private sector made possible by public funds, and therefor the list is not exhaustive. Finally, a list with relevant internet sites is provided.

Is the Belgian public aware of the problem of global warming?

In 2017, the Federal Climate Change Service launched its fourth public survey to gain a better understanding of the (evolution between 2005 and 2017) of the knowledge of the general public about the climate change problem (causes and consequences, information channels, etc.), the subjective interpretation (urgency, government efforts, possibility of personal contribution, etc.) and the personal attitude (the willingness of each person to do something about it).

The 2017 survey indicated that the Belgians are very well aware of the problem: 85% of them think that climate change is a problem that urgently needs to be tackled, 7% denies the problem. High scores are also obtained on statements about the global character of climate change (83%), the already visible consequences (84%) and the scientifically proven human cause (80%). But unfortunately, only 34% acknowledges that families are part of the problem: Belgians tend to point the finger mainly at the industry and the transport sector.

The results of this and previous surveys are available via the climate website (www.climat.be/enquete-publique and www.klimaat.be/publieksenquete).

9.2 Raising awareness

In order to raise public awareness, activities addressing the global warming issue directly or indirectly - via specific themes such as energy savings, energy efficient buildings, environmentally friendly mobility, or via broader themes such as the environment and sustainable development - are organised every year across the country. These large-scale initiatives are supplemented by more specific efforts at awareness-raising or by easily applicable practical solutions intended for certain target groups such as the young, energy managers in companies or other professional groups (architects, heating technicians, mobility managers, etc.).

RAISING AWARENESS OF GLOBAL WARMING

9.2.1 Awareness raising by the federal and regional governments

The **federal authorities'** communication to the public is undertaken by the Climate Change Service of the Federal Public Service Health, Food Chain Safety and Environment. Corner stone for its communication is the climate website www.climat.be / www.klimaat.be, offering headings on the causes and effects of climate change, the policy at the international, European and Belgian level, the Belgian emissions, financial support, etc., but also sections devoted to federal campaigns, private actions to be taken, education etc. In addition, there are also a news heading which calls attention at regular intervals to new developments (results of international meetings, reports published, actions taken) and a multimedia library.

At the end of 2013, the **Federal Climate Change Service** also launched a project on the transition to a low-carbon Belgian society by 2050 ('2050 Low Carbon Belgium'). The core of this project is the study 'Scenarios for a Low Carbon Belgium by 2050', in which various scenarios have been developed to reduce Belgian emissions by 80% to 95% by 2050, based upon an online calculator visualising all possible scenarios and their implications in the form of graphics (www.climatechange.be/2050 - www.climat.be/2050 - www.klimaat.be/2050).

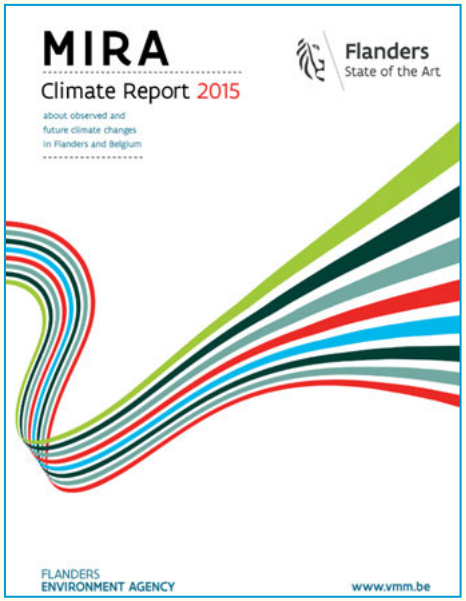
Since that launch, additional communication activities (all available in English, French and Dutch) have been undertaken:

- the **graphical mapping** of all local, provincial and regional low carbon transition initiatives on this 2050 site has been updated regularly, encouraging e.g. local communities to adhere to the Covenant of Mayors initiative
- a fact sheet has been developed explaining the main results of an analysis of the **macro-economic impact** of these transition scenarios on growth, competitiveness, employment and co-benefits
- an **educational "My2050" web tool** was launched in October 2016, aiming to encourage a debate with all citizens (and pupils of the 3rd degree secondary in particular) on how we can make our society evolve towards a low carbon society by 2050 (see 9.3.4)
- "**climate coaches**" were selected, trained and sent out in 2017 in order to promote this My2050 tool and to encourage teachers to use it in class (see 9.3.5)

On the final approval of the **Flemish** Climate Policy Plan 2013-2020, the site www.klimaattips.be was launched. This site focuses on suggestions for a wide range of themes on what each Flemish citizen can do to contribute towards a healthier climate. References are made here for each (sub)theme to relevant sites and internet-consultable brochures with more detailed information. The actions of the Flemish authorities themselves are also described.

The regions take initiatives too, bringing into focus the situation of the living environment in general and the data concerning climate change in particular.

Flanders publishes these data in the MIRA/VMM annual indicator reports, as well as in the online catalogue of indicators which are updated annually on www.milieurapport.be. MIRA also published a detailed report about what climate change means (and will mean) for Flanders and Belgium specifically in the "MIRA Climate Report 2015: about observed and future climate changes in Flanders and Belgium" (with accompanying video summary and infographic). The English version of the report is available on www.environment-flanders.be.



In the **Brussels Capital Region** the environmental administration 'Bruxelles-Environnement' (*Brussels Environment)* continues the publication and dissemination of environmental information via its website, magazines, brochures and leaflets, the organisation of the annual Environment Fes-

tival (to raise public awareness to environmental issues in a festive atmosphere) and the organisation of communication campaigns (television ads, posters, announcements in the press) on rational energy use, promotion of energy-saving investments, as well as on ecomobility.

In 2017, an important communication campaign was launched towards the Brussels citizens to raise awareness about how different actions supported by the Region are contributing to the effort against climate change. Posters, radio and television ads were issued from May on, with the moto "Pour le climat, dessinons un autre avenir" / "We tekenen een andere toekomst uit voor het klimaat". The visual supports were based on drawings made by children from Brussels schools; a Facebook page (www.facebook.com/Climate.brussels) has been created for the campaign. See also the thematic webpage www.environnement.brussels/content/climat or www.leefmilieu.brussels/content/klimaat.

In June 2016, after the adoption of the Air-Climate-Energy Plan of the Brussels-Capital Region, a folder was created to raise awareness about the plan's content.

In **Wallonia**, the Walloon Agency for Air and Climate (l'Agence wallone de l'Air et du Climat - AwAC) makes available to individuals, businesses, municipalities and event organizers carbon footprint calculators which enable to assess carbon emissions in order to raise awareness of the carbon emission impact and to help prioritise climate actions. In 2017 the AwAC has launched an online adaptation platform for municipalities. A vulnerability evaluation tool and several action sheets have been designed to assist municipalities in developing their local adaptation plans as part of their commitment to the Covenant of Mayors.

In April 2016, the Walloon Government adopted the Walloon Air-Climate-Energy Plan. A public awareness campaign called "Les Wallons ne manquent pas d'air" highlighted 142 measures aiming to reduce

greenhouse gas emissions and other air pollutants, to improve air quality and to adapt to climate change impacts. A website was created to that purpose, containing a list of actions to be implemented by individuals, businesses, schools and municipalities. Visitors to the website are also invited to post their own initiatives. About 400 initiatives have been posted since the website went live in October 2016. An Air-Climate-Energy summit also took place during the campaign and brought together various Walloon stakeholders to participate in thematic workshops.

A climate change awareness campaign is being prepared and will start in October 2017. It will run mainly on-line, using social medias. The campaign will target mainly individuals at home, at work and in society.

9.2.2 Earth Hour

For some years, WWF has been calling on all public authorities, cities, businesses and citizens to turn off the lights at the same time for 1 hour in the early evening on a weekend day in March to show their support for combating climate change. This

awareness-raising action, known as 'Earth Hour', is part of an international campaign launched by WWF against climate change. The participants, through this symbolic action, call on governments to take more action, but also to roll up their own sleeves.

In 2014, the Brussels-Capital Region itself was the Belgian laureate of the international contest "Earth Hour City Challenge".

In 2017, 187 countries and territories took part, over 3 000 landmarks switched off their lights and millions of individuals, businesses and organizations across seven continents stepped forward to modify climate change.

RAISING AWARENESS OF ENERGY SAVINGS

9.2.3 October, Month of Energy-Saving

The Flemish Region proclaims the month of October as 'Month of Energy-Saving'. The focus is therefore placed on the theme of energy-saving during that month through a variety of initiatives and press articles.

9.2.4 Avoid energy-guzzlers at home

The federal Climate Change and Product Policy Services continued to invest in the website www.energivores.be / www.energievreters.be. This website carries a calculator for detecting energy-guzzlers in one's home and above all for not letting new ones enter there by purchasing exclusively energy-efficient equipment or insulation materials.

It deals with several household appliances (washing machine, tumble drier, dishwasher, refrigerator, freezer, TV), lighting and cars, as well as windows, roof insulation and wall insulation. The site offers the possibility of making a personal choice amongst all models or insulation materials available on the Belgian market, calculates their energy consumption or heat losses, the corresponding CO_2 emissions and cost, pay-back time, subsidies, etc.

The website, with databases updated monthly, has been promoted at regular intervals via direct contacts with the public at fairs and via appealing pubs showing over-consuming, big fat appliances. More information on the website and the campaign is to be found at www.climat.be/energivores / www.klimaat.be/energievreters.

9.2.5 The TopTen website

TopTen is a website (http://www.topten.be) which allows the most energy-efficient products to be found quickly and easily for the house and the office. It offers an overview for a whole series of products (domestic appliances, lighting, cars, circulation pumps, printers, PC and TV screens) of the most economical models on the Belgian market. It also provides an overview of the suppliers of green electricity. The website is an initiative run by the Bond Beter Leefmilieu Vlaanderen vzw with the cooperation of the Brussels Capital Region, the non-profit association Ecoconso and the European Commission.

9.2.6 Energy saving investments

A whole range of premiums are available to the public or to firms for energy-saving investments (insulation, windows, energy-efficient household appliances, boilers, etc.) and for the installation of photovoltaic or thermal panels or heat pumps at regional level or even provincial and municipal levels. The systems vary depending on regional policy. The Regions make 'facilitators', information desks and websites available to the public to promote these premiums.

Flanders uses several tools and campaigns to raise awareness about energy savings and to convince citizens to take action:

– The campaign "ik BENOveer" (benoveren = better renovation), aiming at stimulating thorough energy renovation of existing dwellings (with a view to achieving the long term renovation goal necessary to achieve the 2050 climate and energy goals). (www.energiesparen.be/ikBENOveer)
– A rapid online calculation tool for the most worthwhile energy-saving investments. The calculators take account of the usual investment costs, energy prices and energy premiums. (www.energiesparen.be/energiewinst)
– In 2021 all new dwellings have to be nearly zero energy buildings. The campaign "BEN je mee" aims at convincing citizens who plan to build a new dwelling before 2021 to go beyond the current obligations and build a zero energy building.
– The 'sun map': the government of Flanders conducted a thorough analysis of 2.5 million roofs in Flanders to determine if they are suitable for solar panels and/or boilers. The results are available via an online tool that gives detailed interactive results for each roof, along with cost calculations. (www.energiesparen.be/zonnekaart)

9.2.7 Assistance to disadvantaged groups of residents

In the **Flemish Region**, more than 30 organisations in the social economy are taking part in the *Energiesnoeiersproject* (Energy Savers project). KOMOSIE vzw is the umbrella organisation for environmental entrepreneurs in the social economy. Energy Savers are low-skilled workers in the social economy who are trained to carry out energy-saving measures, preferably for socially and financially vulnerable

target groups. To guarantee the necessary quality and professionalism in implementation, the Energy Savers are employed and guided by a social economy organisation: the *Energiesnoeiersbedrijf* (Energy-saving firm). The main activities carried out are: free energy scans, insulation of roofs, walls and floors and the performance of a package of 'small energy-saving measures'. Important partners in the project include municipalities, public social assistance centres, building firms, provinces, distribution network managers, social rental agencies and social housing corporations.

In the **Brussels Capital Region**, a versatile social guidance project in the energy sector, known as '*Centre d'appui social Energie*', is run by the Federation of Social Service Centres. It is a reference structure for questions of social workers of the associative sector regarding energy, with a view to enabling them to deal with these problems and to respond adequatly to the various needs of their users regarding energy (internet site, newsletters, publications, trainings, phone and mail permanence, tailored support…). The actions of these centers focus on vulnerable households and add a social aspect to household guidance in relation to the guidance offered by Homegrade, which is intended for the general public (see 9.2.10).

In **Wallonia**, social energy politics are conducted in different ways:

- Social rates for the most disadvantaged groups.
- Low rate loans for renovation, transformation, acquisition or building by the Walloon Social Credit Company (*Société Wallonne du Crédit Social*)
- Subsidies and loans are granted in specific Ecopack and Renopack formats (respectively for construction and renovation).

Between 2017 and 2019, the Public Social Action Centres (*centres publics d'action sociale* - CPAS) can submit projects in order to develop municipal Prevention Action Plans in the field of Energy (*plans d'action préventive en matière d'énergie* - PAPE). The PAPEs inform the public on rational energy use, consumption management and existing energy aids and premiums. The PAPE actions also encourage individual support in three steps: the energy balance of the household, identification of possible solutions and supporting the household in the implementation thereof.

9.2.8 Energy consultants

In the **Flemish Region**, energy consultants are made available with government support to various sector federations and non-commercial organisations to raise awareness of their target groups, to inform them and guide them in the field of energy-saving and renewable energy production. There are energy consultants who focus on building professionals, families, SMEs, farmers, immovable property, the tourist sector, etc.

The **Brussels Capital Region** will provide specific training for "PLAGE responsible" as provided by the PLAGE legislation (see 9.2.11).

As of 2009, **Wallonia** has introduced facilitators for project holders, schools, companies etc., in the field of rational energy use and production technologies. Their basic mission is to provide a first line support by phone and mail, and to facilitate the information flow between project holders and administrations. They also support the administrations with balances, projections, studies, surveys, lists of premium admissible materials etc. They train future auditors, support companies in their "prechecks", offer guidance, organise sectorial practice sharing etc.

Subsequently, according to their role, their missions become more specific:

- The facilitators specialised in rational energy use address the industry, the tertiary sector, the non-profit sector and the self-employed. They stimulate the reflection on energy consumption reduction.
- The technological facilitators (renewable energy only) are subdivided in three groups: electrical technologies/cogeneration, hot technologies and biomass. Their task is, among others, to perform feasibility pre-studies and to compute their sectors' statistics.
- The educational sector consultants allow to integrate energy notions in the primary and secondary school courses.

9.2.9 Enerpedia - Energy Knowledge Centre for Agriculture

Enerpedia is the agricultural energy encyclopedia in Flanders. It gives answers to questions about energy saving and renewable energy relevant to agriculture. In short, Enerpedia sensitizes and advises farmers to handle energy efficiently. They give tailor-made advice and organize demo sessions, workshops, info and study days. Enerpedia is a collaboration of 15 agricultural research centres in Flanders, compiling all their knowledge, events, news on energy in agriculture and horticulture in one single website.

RAISING AWARENESS OF ENERGY EFFICIENT BUILDINGS

9.2.10 Guidance for consumers

In **Flanders**, energy advice is given by the provincial and urban support centers for sustainable living and building. These centers are local network organizations that help to translate the principles of sustainable living and building into practice. They disseminate good examples, exchange experiences and provide information tailored to different target groups. Citizens receive information and customized building advice. Local governments receive support and advice in major construction and renovation projects within their own patrimony. Training and information sessions are also organized for construction professionals (architects, contractors).

Additionally, local authorities also operate energy houses in a large number of municipalities.

Introduced in the early 2000s, the main aim of the Energy info points of **Wallonia** is to provide all citizens interested with neutral, objective information and personal advice, free of charge, on energy efficiency and renewable energy sources. Their number increased in 2010 from 12 to 16 and in this way they are optimally distributed throughout Wallonia.

In the **Brussels Capital Region**, a reorganisation of the *Maison de l'énergie – Energie Huis* (Energy House), established in 2011 by Brussels Environment, gave rise in 2017 to **Homegrade**. Homegrade is a new help desk to meet the need for proactive, full guidance to be given to all Brussels' households to provide concrete assistance in undertaking sustainable action regarding their homes, whether in terms of behaviour, installation management or investment and finance. Homegrade offers the same services for Brussels households as the old Energy House (see their descriptions in 9.4.9 in the previous National Communication). (www.homegrade.brussels)

Apart from Homegrade, Brussels Environment continues to support local and regional initiatives for the information and guidance of households, via subsidies (see the previous National Communication). The Brussels Capital Region also prepared a programme aiming to encourage rational energy use behaviour which does not require major financial investments among Brussels households, both tenants and owners, with a specific attention to vulnerable target groups. The participants engage themselves, on a voluntary basis, to make simple practical gestures to reduce their energy consumption.

9.2.11 Guidance for professionals

Call for projects 'Be.Exemplary'

The **Brussels Capital Region** continues each year to launch a call for projects to design and construct exemplary buildings in terms of energy and environment, which is receiving increasing international acclaim. The purpose of the *Exemplary Buildings* competition is to show that it is possible to achieve very high environmental efficiency with new or renovated constructions (for further details, see the previous National Communication).

Since 2016, this call for projects was extended to new themes (valorisation of circular economy, of architectural quality…) and was renamed "Be.exemplary" or "Brussels exemplary Buildings".

Call for 'PLAGE' projects

The programme '*Plan Local d'Actions pour la Gestion Energétique*' (PLAGE - Local Action Plan for Energy Management') is a support programme for those responsible for large building stocks (essentially public authorities so far), aiming to improve the energy efficiency of the building stock for the benefit of the environment and the finances of the institution housed. Several calls for projects have been launched. The projects selected receive methodological and technical support through an Energy Manager for a period of four years. The methodology is described in the previous National Communication.

PLAGE
Plan Local d'Action pour la Gestion Énergétique
Plan voor Lokale Actie voor het Gebruik van Energie

Since 2013, the number of collective housing corporations and schools in Brussels which have implemented PLAGE have increased (now 11 collective housing corporations and more than 100 schools are concerned). The PLAGE methodology gives good results, without loss of comfort and without need of significant investments, as illustrated by the following key figures:

- 2.5 million of m² concerned by PLAGE ;
- an average annual reduction of 17% of fuel consumption ;
- a stabilisation of annual electricity consumption, or even sometimes a slight decrease, rather than the expected increase of 2% ;
- savings amounting to about EUR 4.25 million per year ;
- savings amounting to about 10000 tonnes of CO_2.

The success is such that the Brussels Regional Parliament decided to make PLAGE compulsory from 2018 for certain building stocks. Its success as an energy efficiency methodology has been recognised by Europe under its EUSEW 2013 Awards, in which the project has been classified among the top five finalists in two categories.

Facilitators

The Sustainable Building Facilitator Service, introduced by Brussels Environment and the **Brussels Capital Region**, consists of a network of energy specialists recognised for their expertise resulting from the implementation of a large number of projects both in Brussels and abroad. Their task is to guide developers and building managers independently, impartially and for free with regard to control of energy consumption, rational energy use and promotion of renewable energy sources, at all stages of progress of a project (more details in the previous National Communication).

As outlined under point 9.2.8, thematic facilitators are made available in **Wallonia** for project holders or professionals of the sectors concerned. Thus, Wallonia offers complete services to support industrial designers etc.

Wallonia also grants accreditations to people fulfilling certain conditions: this concerns AMURE and UREBA accreditations. These allow the public concerned to validate the competencies of the technicians they turn to. The UREBA accreditation concerns energy audits or pre-feasibility studies in the public sector, the AMURE accreditation concerns these activities in the industrial sector.

Wallonia also carried out several successive tender calls for the renovation of public buildings, the so-called UREBA (or exceptional UREBA) calls. The UREBA programme aims to support certain bodies willing to reduce the energy consumption of their buildings. The UREBA calls generally concern thermic isolation works to walls and the replacement and improvement of heating and lighting systems.

9.2.12 Knowledge platforms for passive buildings

Pixii - Knowledge platform for energy neutral construction ('Kennisplatform Energieneutraal Bouwen') & PMP asbl ('Plateforme Maison Passive'/pmp) are two independent, neutral organizations encouraging authorities, professionals and the general public to construct buildings with very low energy requirements, based on the concept of the passive building. They distribute information (website, newsletter, brochures, calculating tools, etc.) and provide training, expert evaluations and guidance to professionals and private individuals as well as governmental organisations. Pixii and pmp are certification bodies for passive buildings in Belgium. Pixii also organizes the annual NZEB Symposium and multiple Expert days to professionals, pmp develops tools to help designers (the thermal bridge service and the hygrothermal service). Pixii and pmp contribute actively to establishing standards related to energy in buildings and carry out cutting-edge research (procedures and tools for high-quality energy renovations, thermal bridges, tertiary sector, life-cycle analyses, etc.). www.pixii.be, www.nzeb.be, www.maisonpassive.be, www.ponts-thermiques.be, www.pmp-hygrothermie.be

9.2.13 Energy efficiency certificates and audits

As of 2009, it has become compulsory for an energy efficiency certificate to be drawn up on the sale or renting out of housing. This certificate contains a great deal of information concerning the main energy-saving measures that are possible in the dwelling.

In the **Flemish Region**, everyone can enter their certificate score on the website www.energiesparen.be/testuwepc, which explains how well or how badly their dwelling scores compared to other dwellings.

As described above, **Wallonia** also guarantees audit and certification processes thanks to different certification systems aiming at energy savings and restriction of shortcomings, in order to contribute to the achievement of the objectives. More information is available (in French and in German) on https://energie.wallonie.be. They concern the legislation as well as technical actions related to the energy performance of buildings, the AMURE and UREBA audits (see 9.2.11), heating equipment diagnoses etc.

9.2.14 Eco-construction

The Belgian Regions and the construction sector have undertaken to draw up a benchmark for the labelling and certification of sustainable buildings which will quantify the sustainability of buildings in the form of thematic scores, which will allow an overall score to be calculated for the building. The purpose of this labelling and certification is to put an end to 'green-washing' and to assist the general public in differentiating between buildings with genuine sustainable achievements from those where the sustainability is confined to sales arguments.

As a reminder, the **Brussels Capital Region** also offers a dynamic support of exchange and information in the sector of eco-construction (see the previous National Communication). Special tools have been developed to keep professionals from the building sector informed about sustainable construction, such as:
www.guidebatimentdurable.brussels
www.gidsduurzamegebouwen.brussels
www.portailconstructiondurable.be
www.portaalduurzaambouwen.be.

In September 2015, Brussels Environment took the lead of a EU funded project (Horizon 2020), "Buildings as Material Banks" (BAMB). This project brings 15 partners from 7 European countries together for one mission – enabling a systemic shift in the building sector by creating circular solutions. The project is developing and integrating tools that will enable the shift: Materials Passports and Reversible

Building Design – supported by new business models, policy propositions and management and decision-making models.

In the **Flemish Region**, a transition forum is active with regard to sustainable living and building, better known as DUWOBO. DUWOBO consists of stakeholders such as banks and other financiers, housing producers, the authorities, NGOs, knowledge centres and research institutes, federations and producer organisations. This very interactive platform has the task of tracing out an innovation course in the field of sustainable living and building for the next 20 years. www.duwobo.be

In the **French-speaking community**, the non-profit association Ecoconso has, over the past 25 years, encouraged environmental and health-friendly consumer choices and behavior. Being sufficiently informed and critical to consciously choose what you buy, and taking environment and health into account, is complex. How to balance things between real qualities and advertising discourse ? Ecoconso has therefore decided to create a shopping guide serving as an effective and objective "shortcut" for consumers: www.suivezleguide.be which concerns eco-building materials and ultimately aims for a wide range of products in various sectors. The Employment Environment Alliance in Wallonia, whose objective was to promote the construction sector's transition to sustainable development, was the opportunity to make this guide a reality, starting with the theme of eco-building materials.

RAISING AWARENESS FOR AN ENVIRONMENTALLY FRIENDLY MOBILITY

9.2.15 Promotion of sustainable mobility

In the **Flemish Region**, active efforts are being made in awareness-raising and communication to achieve a change in behaviour concerning the choice of transport. In many cases with assistance from the public authorities, all kinds of campaigns have been developed, such as the annual Mobility Week, car-free Sundays, the sustainably to school project, *Sam de Verkeersslang* (Sam the Traffic Snake), projects involving car and bike sharing, the Flemish Bicycle Week, campaigns concerning public transport (bus, train and tram), etc. In addition, the Pendelfonds (Commuting Fund) subsidises projects promoting sustainable home-to-work trips.

The **Brussels Capital Region** continues to organise the following actions of raising awareness on mobility, already described in the previous National Communication, in order to reduce pollution generated by road transport, encourage alternatives to cars and to improve environmental performances of the vehicle:

- guidance for schools in drawing up a school mobility plan;
- the Bike Experience campaign;
- the Mobility Week;
- the 'active modes' map;
- the 'Villo' bike hire scheme;
- the Company Mobility Plan. In 2014, the compulsory measures were enforced for public authorities, forcing them to analyse to implement a sustainable fleet management and quota on procurement of **electric vehicles**. To support the company mobilitymanagers to implement their sustainable mobility plan, the region offers them training and tools e.g. to organise awareness raising campaigns.

Wallonia strives for more sustainable mobility through numerous actions, among which:

- Support to companies, schools and administrations in organising their mobility, including (among other things) the elaboration of mobility diagnoses "home to school" and "home to work".
- The implementation of a regional mobility centre in collaboration with local mobility centres in order to meet the citizens' needs in any situation.
- Promoting carpooling in Wallonia.
- Dressing and implementing the "Cyclable Wallonia Plan" (*Plan Wallonie cyclable*) aiming to promote the use of bikes, among others in the educational context, by projects such as "*vélo education*" and "*brevet du cycliste*" and by promoting the electrically assisted bike, by means of a project making these bikes available to citizens for a 15 days period.
- Training mobility consultants, mobility and road safety referents in the school environment, and company mobility managers.
- The mobility documentation centre.
- The organisation of sensitivity actions for sustainable mobility, among which the Mobility Week and spreading mobility information on the portal site "mobilite.wallonie.be". the portal site.

9.2.16 Eco-driving

Training is proposed to promote a driving style which is respectful of the environment.

Eco-driving is part of both the practical and theoretical driving exam in **Flanders**. Specific courses are available for professional drivers. All professional drivers working for the Flemish public authorities or the Flemish public transport company De Lijn followed an eco-driving training and receive periodic follow-up trainings. Public transport buses are equipped with driving style meters.

In the **Brussels Capital Region**, information stands on eco-driving are organised during events and training sessions on eco-behaviour are part of the training of bus drivers of the Brussels transport company STIB.

9.2.17 Raising awareness on the purchase of energy efficient vehicles

The **federal** Climate Change Service updates monthly the database of its online **CO_2 Guide to Cars**, enabling citizens who wish to purchase a new vehicle to compare the various models available on the Belgian market. The guide allows quick searching and lists for each model the cat-

egory of CO_2 emissions (from A to G), CO_2 emissions, fuel type and fuel consumption. The guide is available via the energy-guzzlers website (www.energievreters.be/auto and www.energivores.be/voiture).

In the **Flemish Region**, information on energy consumption and vehicle emissions is disseminated via vast information and awareness-raising campaigns, as well as via training for car sellers. The Ecoscore of a vehicle (a scale from 0 to 100) gives the overall environmental score, independently of the technology, taking into account the emissions released in the fuel or electricity production as well as greenhouse gas emissions, air-polluting emissions and engine noise. www.ecoscore.be

Specific campaigns also promote environmentaly friendly technologies such as electric, plug-in hybrid, fuel cell (hydrogen) and compressed natural gas vehicles. www.milieuvriendelijkevoertuigen.be

A Low Emission Zone (LEZ) covering the entire territory of the **Brussels-Capital Region** will be in force from 01/01/2018. It will be applicable every day of the week, 24 hours a day. Only the oldest diesel vehicles will be affected in the first year: the criteria will change over time so that gradually more vehicles will be involved. A special webpage provides information about the LEZ and its expected impacts on climate, and promotes alternative mobility options available in the Brussels Region. www.lez.brussels

9.2.18 Logistics consultants

In the **Flemish Region**, logistics consultants are made available free of charge to firms. The adviser examines, together with the firm, the possibilities concerning co-modality, green logistics, combined goods flows, bulk consignment, optimisation of transport movements over time, etc.

RAISING AWARENESS ON THE ENVIRONMENT AND ON SUSTAINABLE DEVELOPMENT

9.2.19 Belgian Environmental Awards

Since 2006, the yearly Belgian Energy and Environment Awards acknowledge those who, either as individuals or via their organisations, contribute in an exceptional way to building a sustainable future at the local, regional and national levels. The Award is supported by industrial and institutional partners, as well as by the International Polar Foundation.

Several awards are granted: e.g. in 2017 a sustainable education, sustainable mobility, sustainable energy, sustainable building and circular economy award, as well as some special prizes, were awarded to a project in each target group: citizens, private sector, non profit sector, public sector, educational centres and NGOs, and communities and cities.

In 2015, Brussels Environment itself obtained the EEAward in the category Public Sustainable Development Award, for its new passive office building and new working organisation (flex desk and open space, paperless office, mobility policy).

The Federation of Enterprises in Belgium (FEB) also organizes every two (odd) years the Belgian Business Awards for the Environment (BBAE), which reward every company contributing to sustainable development. They highlight those that have succeeded in combining outstanding economic and environmental performances in an innovative and intelligent way. Four categories of awards have been foreseen: management, product & services, process, international business cooperation, each of them containing two sub-categories: 'young talent' and 'enterprise and biodiversity'.

A panel of independent experts designates the TOP 3 winners among the best projects. They have access, together with up to 9 runners up, to the competition at the European level, the European Business Awards for the Environment, organized by the European Commission every two (even) years. They will also have the chance to get in touch with the different stakeholders.

9.2.20 Eco-efficiency scan

Eco-efficient companies use less energy, less water and less raw materials to create and distribute their products and take the eco-efficiency of their product throughout the entire life cycle. This constitutes a win-win for both the environment and the company (lower expenses, better competitiveness).

In **Flanders**, companies can take an online eco-efficiency scan that provides information regarding various aspects of eco-efficiency: introducing more environmentally-friendly processes, designing (converting to) more environmentally-friendly products, using waste, re-examining the markets, adapting demand and making economic and ecological benefits discernible.

9.2.21 Corporate social responsibility

Corporate social responsibility is an improvement process in which businesses, on a voluntary basis, systematically and consistently include social, environmental and economic considerations in their business management, in consultation with their stakeholders (customers, staff, suppliers).

The **Flemish government** has set up the Corporate Social Responsibility Knowledge Centre to inform and inspire businesses.

Brussels Environment is organising a large number of information and training sessions on environmental themes (energy, eco-construction, mobility, etc.). The seminars, colloquiums and guided visits are intended to inform professionals about the current legislation and the latest technological developments, to pass on technical advice from specialists and feedback from other bodies and to allow them to become familiar with exemplary installations. The training is organised in cycles which take place over several months and usually end with an evaluation leading to a certificate. The training is intended for a specialised public wishing to acquire specific knowledge in the technical field.

9.2.22 Sustainable Neighbourhoods

In 2007, **Brussels Environment** set up an operational strategy with a view to promoting the emergence of particularly exemplary neighbourhoods with regard to sustainability in the Brussels Capital Region, as mentionned in the previous National Communication.

Thanks to the hard work of the Sustainable Neighbourhoods' facilitator (for its missions, see the previous National Communication), the transition towards sustainable planning and building practices in the Brussels Region has now, anno 2017, passed from the niche-level at micro-scale to the take-off-level so as to really influence the existing socio-technical regime. More specifically, Brussels Environment reached out to the different regional planning and operating institutions in the Brussels Region to co-produce a regional neighbourhood sustainability assessment tool serving as a reference framework for the concept "Brussels sustainable neighbourhood". Several public and private neighbourhood developers have been approached so as to test this new tool and to be guided by the Sustainable Neighbourhoods' facilitator. More and more actors are involved in the process and are interested in the tool which makes sustainability now increasingly considered in an holistic way and seen as a true objective when developing a new area in the city and creating a better quality of life.

In the **French-speaking Community**, "Streets in transition" ("Rues en transition") are groups of 6 to 10 people/families, living in the same street. Participants choose low-cost, easy-to-implement

actions in order to reduce their bills (energy, water, fuel…) and their ecological footprint. The support of the group creates an enthusiastic and effective dynamic. The street scale is an accessible level to bring about change. Recreating social ties with our neighbours enables to get out of solitude and individualism: a first step towards better living in our neighbourhoods.

Wallonia co-funds dozens of projects in collaboration with other countries/regions and with Europe (structural funds). Projects such as CAN (Climate Active Neighbourhoods) aim to allow the renovation in deprived neighbourhoods, or ACE-retrofitting (Accelerating Condominium Energy Retrofitting) aiming at lowering the normative barriers in order to increase energy renovation in co-owned buildings.

9.2.23 The 'Eco-dynamic Entreprise' label

The 'Eco-dynamic Enterprise' label (Entreprise éco-dynamique / Ecodynamische onderneming - coordinated by Brussels Environment) is a regional public certificate conferred upon organisations (companies, associations, administrations) that voluntarily undertake to implement an environmental management system based on the principle of ongoing improvement in all environmental fields, including energy and mobility (for more details, see the previous National Communication-9.4.16).

In relation with the Regional Programme in Circular Economy in Brussels, adopted on March the 10th, 2016, the 'Eco-dynamic Enterprise' label guides organisations to implement circular solutions in their daily and/or strategic management: rethink waste and procurement management, look for synergies, etc.

9.2.24 The Walloon Youth Parliament for Sustainable Development

The Walloon Youth Parliament for Sustainable Development is an action of the 2nd Walloon Sustainable Development Strategy (2016-2019). Its objective is to promote participation of young people in the reflexion on sustainable development. More specifically, this initiative aims to enrich participants' knowledge about sustainable development, to give them the opportunity to meet experts in the field and to encourage collective reflection during plenary and parallel working sessions. The recommendations resulting from this work are submitted to the Walloon Minister in charge of sustainable development.

The first edition of the Youth Parliament took place on May 2nd, 2015 at the Parliament of Wallonia to conclude the consultation phase on the 2nd Walloon Sustainable Development Strategy. The second edition was held in February and March 2017, in the form of a 3-day program devoted to sustainable food, the first theme of the action plan of the Walloon sustainable development strategy. Around 40 (non-)university students participated to these programs.

9.2.25 Sustainable Development Days in Wallonia

The Sustainable Development Days is an event dedicated to discover many sustainable development initiatives in Wallonia. A lot of associations participate to this event by organizing animations and holding information stands. Launched by the Walloon Minister in charge of sustainable development, the first edition was held in October 2016 in Mons. The second edition took place in April 2017 in the same place, in the form of a 3-day program: the first day for associations and local authorities, the second day for families and the third day for schools.

9.3 Education and training

EDUCATIONAL PROJECTS

In Belgium, education comes under the jurisdiction of the Communities: the French, Flemish and German-speaking Communities.

In the official primary and secondary education, the theme of climate change is generally treated in a transversal manner, incorporated in the broader programmes relating to nature and environment or sustainable development. Nature and environmental education is today firmly anchored in the Belgian educational system. Its pedagogical objectives rest on four stages: discovery, understanding, assessment and action.

Some activities of education in sustainable development, both inside and outside the school, are conducted by a growing number of actors in society.

9.3.1 Educational climate dossier

Early 2017, the Federal Climate Change Service and WWF decided to review completely the educational dossier *Le climat, c'est nous* (French) / *In de weer voor het klimaat* (Dutch), addressed to teachers and pupils of the final years of primary school and the first two years of secondary school (10-14 year-olds). The binder file, containing theme sheets (composed of information sheets for the teacher and prepared work sheets for pupils) and emphasizing a.o. the interrelationship between our lifestyle, climate change and biodiversity, will be converted - early 2018 - into an attractive and interactive website with lesson materials, quizzes, multimedia, practical assignments… (www.wwf.be/school and www.wwf.be/ecole)

9.3.2 The 'Climate Challenge' website

In 2012, WWF, the Free University of Brussels (VUB), the Erasmus University College of Brussels and the North-South NGO Studio Globo, in cooperation with the federal Climate Change Service, launched the website www.climatechallenge.be for the top four years of secondary schools

(15-18 year-olds). This is an attractive virtual, multidisciplinary learning environment, geared to both the Dutch-speaking and the French-speaking educational context, in which teachers and pupils find the necessary lesson sheets, video clips on climate issues or on practical solutions, video interviews with scientists and climate watchers, background information, etc. This website especially draws attention to the impact of climate change on the population in the south. During the school year 2015-2016, 153 000 people visited the site.

9.3.3 The 'Climate Challenge @ School' conferences

The same project partners (see previous item) launched the idea of organizing climate conferences at the school compound. During these days, pupils simulate the international climate negotiations. They are assigned a country in advance which they have to represent during the meeting. The preparatory work in class allows them to discover the economic, ecological and geographical situation of 'their' country and to obtain good insight into the challenges for the negotiations they are going to conduct.

After this preparation period, the representatives from the different (types of) countries meet around the table to reach an agreement on 3 concrete resolutions in the field of aviation, food and a general climate agreement. In the course of the discussions, views are put forward, amendments drawn up and alliances formed between countries.

A fascinating experience in a realistic setting which achieves its objective: to make young people reflect on climate issues.

During the school year 2015-2016, conferences were organised in 20 schools (11 in Dutch and 9 in French). A closing event was organized in April 2016, with more than 300 participating teachers and students. During the next school year (2016-2017), the number of participating schools raised to 29 (19 in Dutch, 10 in French). These activities will be continued.

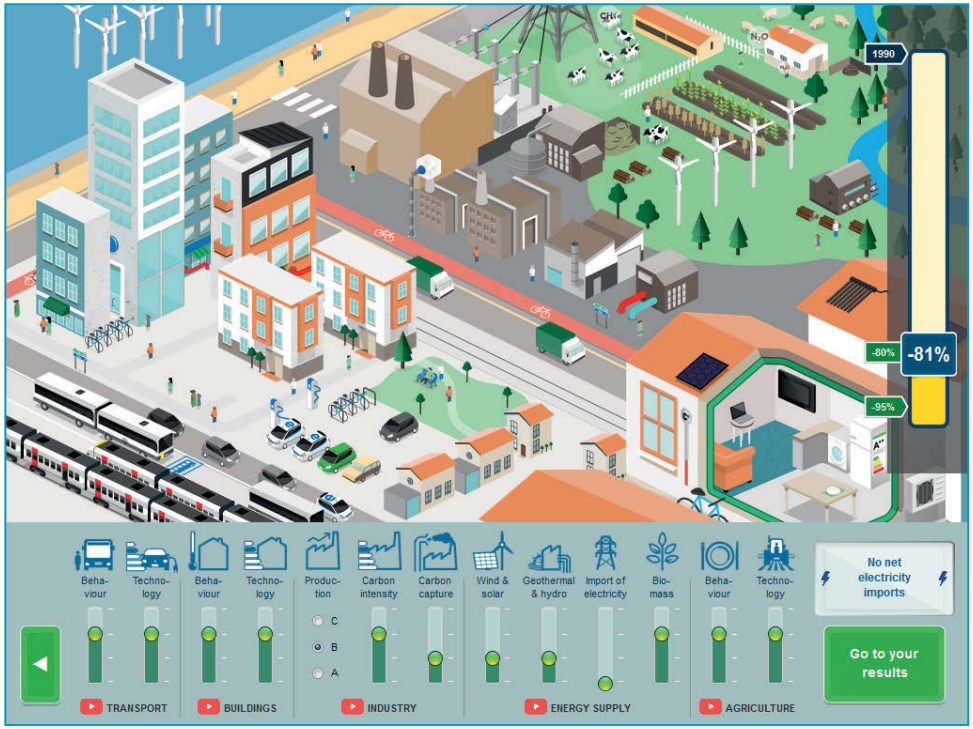
9.3.4 The My2050 web tool

This interactive educational web tool (www.my2050.be), launched in October 2016, aims to encourage a debate with all citizens - and pupils of the 3rd degree secondary (aged 16 to 18 years) in particular - on how we can make our society evolve towards a low carbon society by 2050.

My2050...

- provides insight into the changes that are possible in transport, buildings, industry, energy supply and agriculture.
- enables the user to develop his own transition scenario by selecting an ambition level for the various "levers" in these sectors. Each choice is immediately visible in the virtual interactive landscape.
- immediately calculates the emission reduction of this scenario for Belgium in 2050.
- analyses this scenario with regard to emission reductions, energy demand and net import and export of electricity, and also calculates its costs.
- provides clear information through 7 video animations and an info sheet for each lever.
- provides the teacher with a manual for optimal use in class.
- provides the possibility to save, compare and share your scenario.

'My2050.be' is available in English, French and Dutch and is an initiative of the Federal Climate Change Service in collaboration with Climact (calculation model), Climate Media Factory (web tool development), Cronos/Legioen (animations) and WWF (manual for teachers).



9.3.5 Invite a Climate coach into your (secondary) school

In order to promote the My2050 web tool (see previous item) and to help teachers use it in class, the Federal Climate Change Service planned to send out "climate coaches" in 2017. In collaboration with the project partner GoodPlanet Belgium, a dozen young university graduates or young professionals, disposing of a multidisciplinary knowledge and experience on education and the environment, and with good communication skills have been selected. They followed an intense training programme set up by the project partners.

As from March 2017, teachers from secondary schools (3rd grade) had the opportunity to invite these climate coaches in their class. The coaches guide the teacher and the pupils throughout the web tool and encourage them to get an understanding of the challenges in different sectors, to discuss possible ambition levels for behavioral or technological solutions in different sectors, and to evaluate the results of their preferred transition scenario. This personal coaching also aims at "teaching the teachers", allowing them to use the web tool independently afterwards.

Between March 2017 and June 2018, 450 sessions will be organized free of charge. After a thorough evaluation a decision will be taken about the follow-up of this project in 2018 (www.climat.be/coachs-climat and www.klimaat.be/klimaatcoaches).

9.3.6 Solidar'Climat

Solidar'climat is an initiative by COREN asbl, in cooperation with the Walloon Agency for Air and Climate, and aims to make young people aware of the impacts caused by our consumption patterns, our activities and our greenhouse gas emissions.

Through this initiative, pupils

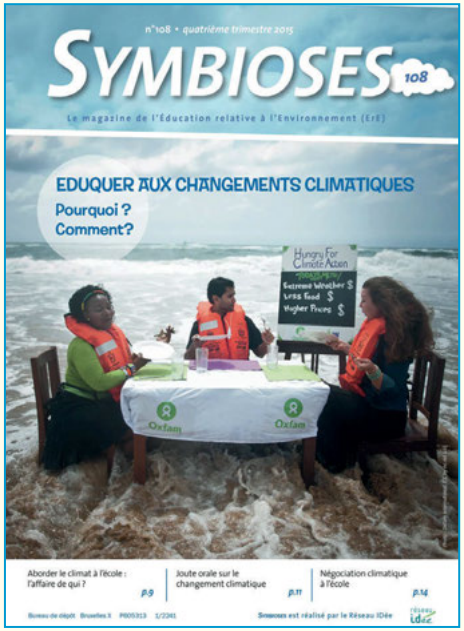
- measure the carbon footprint of their schools to assess the impact of school activities on climate,
- take up challenges to reduce their carbon footprint, and
- share ideas and solutions with other schools in Belgium and abroad.

Fifteen schools took part in this initiative from October 2016 to May 2017. Figures collected show that the mean carbon footprint per pupil amounts to 890 kg CO_2-eq. The tools developed through this initiative will be made availabe to other schools in order to further raise awareness.

9.3.7 Symbiose "climat"

In the run-up to the International Climate Conference (CoP) in Paris in December 2015, the Idea Network (Réseau Idée asbl) conducted a series of activities related to climate education:

1. A meeting day with stakeholders' organizations about climate education, held by the Walloon authorities on the 4th of September 2015 as part of the Cooperation Agreement between the French-speaking entities of Belgium on Environment Education.
2. On the eve of the CoP in Paris, the Réseau IDées asbl published a thematic edition on climate education of "Symbioses", an environment education magazine, as a complement to the publication on Energy Education early 2015.



3. A communication to the Belgian media prior to and during the Paris Climate Conference, in order to emphasize climate education and related resources, best practices and challenges.
4. An event bringing together the Energy and Climate Ministers in French-speaking Belgium and the Education Minister, and emphasizing in particular their coordination activities in schools through the Cooperation Agreement relating to Environment and Sustainable Development Education (ErE DD).

9.3.8 Initiatives addressing energy efficiency in schools

In **Wallonia**, the project 'Génération Zéro-Watt', coordinated as of 2010 by the educational energy facilitator, strives to sensitise pupils by involving them in participative audits. This is a true contest, allowing an average electricity consumption reduction of 15% per educational institution. The pupils are directly involved in actions promoting both behaviour and consumption changes. Furthermore this allows schools to make low-cost changes in order to improve the energy efficiency of the heating systems in their buildings. This way, fine-tuning the heating has allowed to save 10 to 20% of energy per school site over the period concerned.

Furthermore, "Hypothèse asbl" developed several pedagogic tools that are spread and used in schools today. They are meant to sensitise the pupils for rational energy use, but also for the importance of insulation and system efficiency.

As of 2003, Wallonia co-funded sensitising workshops about the environment, nature and energy organised by "Vent d'Houyet académie", in order to make the public aware of the importance of environmental preservation thanks to rational energy use, based on a real-life field experience.

Wallonia supported projects on windmill and watermill building in technical schools. These projects were conducted between 2013 and 2015 in the "Institut Don Bosco" of Verviers. These handmade machines, to the pride of the students who built them, really work and produce renewable energy.

In 2015, "Espace-Environnement", a non-profit association formalising good practices with local authorities (municipal administrations) was financed by Wallonia in order to model good practice charts in order to implement the Energy and Climate Action Plans in Walloon municipalities.

9.3.9 The MOS project (Milieuzorg Op School - Respect for the environment at school)

MOS is a project of the Flemish authorities on care for the environment from nursery to secondary school. MOS helps schools to create an environmentally friendly and sustainable learning and living environment, together with students, staff and network. Participating schools

receive tailored guidance, information and inspiration, networking opportunities… MOS belongs to a worldwide network of schools that pursue care for the environment and sustainability (www.ecoschools.global).

MOS has always worked on topics with links to climate change such as energy, mobility… Additionally, MOS started with specific climate projects for both primary and secondary schools in 2016.

9.3.10 Cooperation Agreement on education concerning the environment, nature and sustainable development

In order to facilitate the cooperation between the Walloon Region, the Brussels Region and the 'Fédération Wallonie Bruxelles', a cooperation agreement was signed in 2011 to establish a partnership structure between the concerned administrations. It also defines a series of priority objectives among which the multiplication of information channels, better incorporation of nature and environmental education in the school syllabus, support for schools wishing to include Sustainable Development in their project and the setting-up of reciprocal exchanges for the purpose of improving pedagogical practices. www.coopere.be

9.3.11 Raising environmental awareness for schools

Brussels Environment continues the actions of raising environmental awareness in Brussels' schools which are described in the previous National Communication.

From 2013 tot 2017, 732 classes received an animation cycle offered by Brussels Environment and organised by specialised animators with a view to an activity which combines knowledge acquisition to environment-friendly actions.

Each year Brussels Environment launches a call for projects on the various environmental themes in which methodological support is offered, including several visits by an expert facilitator, activities for students and training for the educational team or school staff, as well as financial support for the implementation of the project. Between 2013 and 2017, 119 projects were carried out, reaching 47474 students.

The Brussels Capital Region, with its non-profit partner COREN, participates in the Eco-Schools programme and its international label which rewards the ongoing work of schools in environmental education and environmental management. The international network of Eco-Schools includes almost 49 000 schools in 64 countries.

Finally, a network of Brussels' schools in action for the environment, denominated Bubble, was created in May 2013 to enable active teachers to share and exchange their practice and experience. Meetings are regularly organized (thematic meetings deepening the subject including the discovery of educational tools, pedagogical and methodological trainings, visits to school projects, events) and a website allows to promote the schools' projects. (www.bubble.brussels).

Apart from the directly offered services, the Directorate for Raising Environmental Awareness of the **Walloon Region** is continuing its collaboration with a range of associated partners performing specific assignments, providing information and developing activities in the area of nature and environmental education.

The Walloon Region orders the writing of pedagogical materials by associations specialised in nature and environmental education. The majority of the documents are also downloadable on the site environnement.wallonie.be.

In the Walloon Region, within the framework of the campaign "Schools for Tomorrow" ("Ecoles pour demain"), the non-profit organization COREN accompanies schools that carry out environmental actions for sustainable development. This campaign proposes schools to develop and to carry out environmental actions and projects on themes such as living environment, eco-consumption and waste management, climate change and energy saving, mobility, food waste and water management.

COREN is also supported by the Walloon Region for the "Agenda 21" school initiative, the objective of which is to support schools in developing a sustainable development education strategy combining sustainable resource management, participatory dynamics and young people's formation to sustainable development. The "Agenda 21" approach is based on a series of clear and precise steps, of which the touchstones are the constitution of a steering committee, the realization of a diagnosis, the elaboration of an action plan and the planned evaluation of the approach's implementation. If the school meets all the requirements stipulated in the specifications, a label is awarded. It recognizes the dynamics put in place and promotes the approach as well as all the actions carried out.

9.3.12 The network of Regional Centres of Initiation to the Environment (CRIE)

Alongside their normal tasks as a public service for information, awareness-raising and nature and environmental education, the 11 regional environmental initiation centres (*Centres Régionaux d'Initiation à l'Environnement* – CRIE) of the Walloon Region provide an animation methodology and didactic scientific material for the general public. Their main activities include school animations, training courses, activities for families and holiday courses. www.crie.be

9.3.13 The Educational Forum on the environment and sustainable development

The Educational Forum on the environment and sustainable development project was set up on the initiative of the Ministers for the Environment of the Walloon and Brussels Capital Regions (for more details on its objectives, see the previous National Communication – 9.6.6).

9.3.14 Ener'jeunes

Ener'jeunes is an operation intended for 10 to 12 year-olds who are members of a Children's Town Council. Objectives: to make young people aware of sustainable development and invite them to set up projects on the subject within their municipality.

9.3.15 Idea Network

The Idea Network (Réseau IDée, for "Information and Diffusion about Environmental Education") is the main centre of information for nature and environmental education (EE) in the french-speaking part of Belgium (Wallonia and Brussels). The network has currently more than 120 member associations and its main objective is to inform and to strengthen ties between all actors concerned: teachers and educators at all levels, community education workers, parents, environmental advisers, etc.

All parties concerned are offered a wide range of pedagogical tools, a documentation centre, a database, internet sites and personalized support. Réseau IDée also organizes exchange meetings and reflection days. It promotes the EE's strategic positions through dialogue with public authorities. It prioritises people who regularly offer activities and tools to raise awareness of the interdependence between environment, social progress and economy. Its magazine "Symbioses" is also sent to all French-speaking schools in Wallonia and Brussels. In 2015, a special

edition of this magazine entirely dedicated to climate change education has been edited (see 9.3.7). (www.reseau-idee.be)

9.3.16 GoodPlanet

In the Brussels Region and in the Walloon region, the non-profit organization GoodPlanet Belgium has been assigned the task of developing and promoting an information structure for education about nature and environment for Dutch- and French-speaking primary and secondary school networks.

GoodPlanet continues to organise the following actions, described in more details in the previous National Communication, under a campaign entitled GoodPlanet Actions (formely called *'Effet de jeunes contre effet de serre'* (the young turn the climate):

- Warm Pullover action; today, this action is called 'Baisse les Watts' and it was broadened to include the electricity consumption in its fight against energy waste. Thus this action is no longer limited to heat consumption ;
- a local and seasonal fruit day, with reflections on the transport of food and implicit energy consumption;
- a 'Zero Waste' action day.

Each year, over 500 Belgian schools sign up to this campaign (www.goodplanet.be/goodplanetactions).

9.3.17 Commitment to the planet and energy ambassadors

For the school years 2012-2016, 16 schools took part in this project, which is described in the previous National Communication (9.6.16).

9.3.18 Going to school by bike

In the **Flemish Region** too, efforts are made in this respect with the project '*duurzaam naar school*' (Sustainably to school) and the campaign '*Sam de Verkeersslang*' (Sam the traffic snake).

Bike2school is a great common challenge launched by Pro Velo for elementary and junior high school students, their teachers, school directorates and parents to maximize the use of bike during 2 weeks. Proposed since 2013 in **Wallonia** with the support of the Walloon region, the challenge has been extended since 2016 to the **Brussels Region** and thousands of children have already taken up the challenge. Children register on the website with their family, their class or school. Once enrolled, they ride their bike as often as possible and then encode their trips and challenges directly on the website. A counter adds up all the kilometers traveled and moves the characters forward. The more kilometers they accumulate, the more characters leave a polluted Earth to join a green and airy world! www.bike2school.be

In **Wallonia**, 20% of the fifth primary year pupils were granted the "biker's certificate" (*Brevet du cycliste*), aiming at making the children independent on their bike over a known trajectory. Besides, the project "bike objective" (*objectif vélo*) intends to stimulate a modal shift toward biking for the home-school transfer, which may total up to 30% of the modal share.

9.3.19 Thick Jumper Day

The initiative *Dikke truiendag* (Thick Jumper Day) was launched on 16 February 2005 – the day on which the Kyoto Protocol entered into force – under the aegis of MOS (see 9.3.9) and the Flemish Government. On this day the heating was lowered by 1°C to remind us of Belgium's commitments in terms of reducing greenhouse gas emissions and symbolically, pupils or employees of participating companies wear warm pullovers.

Ever since, the Thick Jumper Day has been organised every year in February. It calls on everyone to pay attention to the major challenges of climate change. The campaign mainly aims at simple energy-saving measures which can also be maintained subsequently in a structural way. MOS uses this Day as the starting and final point for more comprehensive climate projects.

This day corresponds to the GoodPlanet Action 'Baisse les Watts', in the French-speaking part of Belgium (see 9.3.16).

9.3.20 Association for the promotion of renewable energy (APERe)

The mission of the '*Association pour la Promotion des Energies Renouvelables*' (APERe) is to support citizens and communities in their appropriation of energy towards a 100% renewable, sustainable and solidary system.

Recognised as a "permanent education" organisation by the Wallonia-Brussels Federation, APERe conducts education and counseling on the basis of projects (campaigns, information, training, facilitators, studies of collective interest) and field activities (stands, conferences, animations), in four areas: Prosumers, Cooperatives, Territories and Observatory.

APERe brings innovation in its field of expertise by communicating in a positive and engaging way about renewable energy towards the citizens. Among others, the association brought renewable energy indicators in the weather forecast, helped more than 200 Walloon municipalities to join the Covenant of Mayors and created a one-stop website to invest in renewable energy cooperatives (www.coopalacarte.be).

APERe is also the statistics reference on renewable energy in Belgium. With its members and partners, APERe is also a network that brings together academic and associative skills in Wallonia and Brussels.

9.3.21 Training for building professionals

Brussels Environment is coordinating the training policy 'city and sustainable buildings' of the **Brussels Capital Region**. The aim of this policy is to develop professionals' skills in the field of sustainable city and buildings, to enable them to achieve progress in moving the Brussels building stock and the city in general towards the policy objectives of Brussels in this field. Its main priorities are described in the previous National Communication (see 9.6.20).

In **Flanders**, training for building professionals and other trades in the construction sector is also being undertaken, from pupils still in secondary schools, over higher education and professionals already in the field.

HIGHER EDUCATION

9.3.22 Awareness-raising at the university

In **Brussels**, the Science Spring, organised by various universities since 2000, each year presents workshops and student projects for schools and general public: the theme of climate is included (http://www.printempsdessciences.be/bruxelles).

In **Flanders**, colleges and universities organise regular awareness-raising actions, including via the Ecocampus project. With this project, the Flemish Region urges colleges and universities to include environmental care and sustainability in their organisation. They receive the necessary support for this in terms of methodology and content. Students are encouraged during their education to treat the environment with respect and subsequently to maintain this attitude in their professional careers. They receive help in including environmental care in their student life. www.lne.be/ecocampus-english

9.3.23 Education on Environment and Sustainable Development

In the field of Education for Environment and Sustainable Development (named hereafter EESD / Éducation relative à l'Environnement et au Développement durable, ErE DD), the Citizenship Unit of the **Wallonia-Brussels Federation**, among other things, strives to enhance, strengthen and coordinate existing initiatives. This is why it organizes meetings, animates and develops synergies with different partners working on citizens and environmental themes.

An audit on the Education for Environment and Sustainable Development in schools

In 2014, an audit of the General Inspection Service investigated various issues concerning the impact of the Education for Environment and Sustainable Development in schools, the effects on pupils, on teachers and on the school's educational project, on the possible improvements, etc. This audit confirms the interest in this type of education in schools, while highlighting the need to professionalize practices and remove barriers, particularly in terms of environmental management. On February 11, 2015, a multi-stakeholder morning (teachers and administrators, trainers, university researchers, administrative staff and political representatives) was organized to present the results of this audit and to examine some recommendations.

Survey on the place of the Education for Environment and Sustainable Development in the Teacher's College

From March to August 2015, a survey was carried out by the IDea Network (réseau IDée) on the place of the Education for Environment and Sustainable Development in the basic teachers' training. The objective was to explore what is being done within the French-speaking tacher's

colleges, what are the levers and obstacles, and to subsequently draw reflections to reinforce the EESD in the initial teachers' training. Following this survey, a meeting and reflection morning was organized, on January 6th, 2016, between teachers and directorates of the teachers' colleges and the leaders/trainers of the EESD associations.

The aim was to create an exchange forum for EESD experiences and practices in initial training, to enable teachers and directorates to become acquainted with EESD associations and their services, and to feed the reflection to reinforce the EESD in the initial teachers' training.

Education for Environment and Sustainable Development assignments ("Assises de l'ErE DD")

In the wake of the EESD assignments ("Assises de l'ErE DD") at school, described more in detail in the previous National Communication (see 9.6.6), an initiative has been launched to document the practices and needs of the Walloon Higher Schools on EESD and to develop reflection dynamics in order to promote EESD in initial teachers' training. Following the survey, a common will emerged to continue the exchanges and to create meeting and reflection places between teachers' colleges (both teachers and directorates) and trainers of EESD associations. www.assises-ere.be

9.3.24 Teach the future teachers

The partnership between the federal Climate Change Service and the North-South NGO Studio Globo (see 9.3.2 and 9.3.3) also led to a project of teaching future teachers. A half day training pack is being proposed to high schools and universities, addressing future secondary school teachers. During such a half day training course, the global warming issue is being dealt with using the sustainable development education concept, giving particular attention to action perspectives at the personal and societal level. In total, 16 training sessions have been organized between September 2014 and June 2017.

INTERNATIONAL COOPERATION AND TRAINING IN SOUTHERN COUNTRIES

9.3.25 Federal initiatives

Table 9.1 provides an overview of capacity building events organized by the Belgian federal Climate Change Service in close cooperation with the respective national entities in charge.

The Belgian federal NDC Support Initiative, launched late 2016, aims to support eligible countries in taking forward the implementation of their Nationally Determined Contributions (NDCs) through the implementation of specific and concrete actions in the fields of GHG Inventories, Policy Development and Implementation & Accessing Climate Finance. The initiative targets francophone countries and partner countries of the Belgian international cooperation. In total, 47 submissions were received from 21 countries.

Rwanda and Cameroon will benefit from support in the field of GHG inventories while Burundi and Ivory Coast will be supported in their efforts to integrate climate change in sectoral and/or local planning. (www.climat.be/NDCsupport).

The Belgian federal government finances the translation into French of the e-learning course of the Greenhouse Gas Management Institute (GHGMI) on 2006 IPCC guidelines for GHG Inventories (http://ghginstitute.org/ipcc/). The translated modules should be available by the end of 2017.

Besides its bilateral actions, the Belgian federal Climate Change Service also financially contributes to and actively participates in multilateral initiatives and partnerships (Table 9.2).

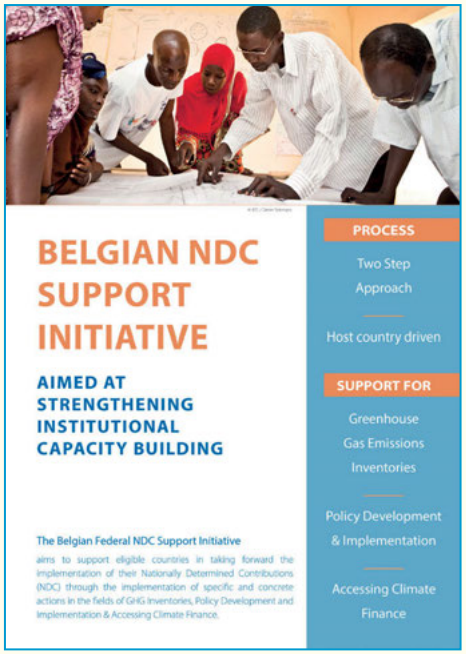


Table 9.1: Capacity building events organized by the Belgian federal Climate Change Service

Theme	Country / national entity	Year	Objectives
Climate Finance	Mozambique / Ministério para a Coordenação da Acção Ambiental (MICOA)	2014	Climate Finance in Mozambique - Identifying and prioritizing appropriate mitigation actions and interventions in the municipal waste and charcoal production sectors: workshop with stakeholders and representatives from national and municipal governments, NGO's, private sector and the donor community to climate finance opportunities. (http://www.climat.be/climate-finance-mozambique)
Climate Finance	Rwanda / Rwanda Natural Resources Authority	2014	Sustainable Charcoal Production and the Potential Role of Climate Financing – Identifying and Prioritizing Appropriate Actions and Interventions: workshop with stakeholders (tree growers, charcoal producers, transporters and wholesalers/ retailers) and representatives from national and local governments, NGOs, the private sector and the donor community to climate finance opportunities. (http://www.climat.be/climate-finance-rwanda)
NAMA formulation	Mozambique / Mozambican Ministry of Land, Environment and Rural Development (MITADER)	2015	A three day in-country training for 15 Mozambican experts working on programmes eligible for international climate financing in the municipal waste and charcoal production sector on the formulation of Nationally Appropriate Mitigation Actions (NAMA). (http://www.climat.be/nama-training-mozambique)

Table 9.2: Federal participation in multilateral initiatives and partnerships

Initiative / Partnership	Contribution / period	Activities
Francophone cluster of the International Partnership on Mitigation and MRV (now renamed as the Partnership on Transparency in the Paris Agreement)	Financial and organisational contribution, in cooperation with Germany (GIZ), France (Ministry of Environment and CITEPA) and Switzerland. Since 2013.	Peer-to-peer learning workshops focusing on MRV related issues, 2 workshops per year. (https://www.transparency-partnership.net/activity/partnership-francophone)
Lusophone cluster	Financial and organisational contribution, in cooperation with Germany (GIZ), Portugal (Ministry of Environment) and Brazil (Ministries of Foreign Affairs and Environment). Since 2017.	Peer-to-peer learning workshops focussing on MRV related issues, 1 or 2 workshops per year.
(I)NDC (regional) technical dialogues, organised by UNFCCC and UNDP	Financial contribution. In 2015, 2016 and 2017.	http://www.undp.org/content/ndc-support-programme/en/home/events.html

9.4. Internet information sources

Several references have been made to websites in this chapter. A list of these and other sites is given for more information on climate change, energy savings, buildings, mobility, the environment and sustainable development, and on the main environmental actors and networks (non-exhaustive list).

GLOBAL WARMING

www.climat.be / www.klimaat.be

This federal site provides information on the causes and impacts of climate change, the policy at different levels, the situation in Belgium, recent data on GHG emissions, daily actions, campaigns, education,... There is also a news heading as well as a multimedia library.

www.climatechange.be/2050 / www.climat.be/2050 / www.klimaat.be/2050

A separate trilingual section highlights Belgium's transition to a low carbon society by 2050, giving access to the results of the studies of transition scenarios and their macro-economic impacts, the calculator for experts and the educational My2050 web tool, a mapping of low carbon initiatives, etc.

www.my2050.be

This educational web tool of the federal Climate Change Service aims to encourage a debate with all citizens (and pupils of the 3rd degree secondary in particular) on how we can make our society evolve towards a low carbon society by 2050.

www.climatechallenge.be

This virtual, multidisciplinary learning environment for the top four years of secondary schools offers teachers and pupils lesson sheets, video clips on climate issues or practical solutions, video interviews with scientists and climate watchers, background information, etc. It especially draws attention to the impact of climate change on the population in the South.

www.klimaattips.be

This website focuses on suggestions for a wide range of themes on what each Flemish citizen can do to contribute towards a healthier climate. References are made here for each (sub)theme to relevant sites and brochures with more detailed information.

www.omgevingvlaanderen.be

This official website of the Environment Department of the Flemish Government presents the policy of the Flemish environmental administration with regard to climate and other issues.

www.milieurapport.be / www.environmentflanders.be

The Flemish Environmental Reporting Service (MIRA) provides a state of the environment and an evaluation of the environmental policy carried out so far, provides projections and regularly publishes indicator reports, research reports, news items, etc. It also published the "MIRA Climate Report 2015: about observed and future climate changes in Flanders and Belgium".

www.environnement.brussels/content/climat / www.leefmilieu.brussels/content/klimaat / www.facebook.com/Climate.brussels

Special webpage designed to support the climate campaign of Brussels Environment, launched in 2017.

http://awac.be

This is the official site for climate and air quality policies in Walloon Region.

www.leswallonsnemanquentpasdair.be

This website highlights 142 measures aiming to reduce greenhouse gas emissions and other air pollutants, to improve air quality and to adapt to climate change impacts. It contains a list of actions to be implemented by individuals, businesses, schools and municipalities. Visitors to the website are also invited to post their own initiatives.

http://leswallonssadaptent.be

"Les wallons s'adaptent" is a platform proposing adaptation actions and examples of actions for the Walloon municipalities.

www.educapoles.org

EducaPoles is the educational site of the International Polar Foundation (IPF). It aims at raising awareness among young people and the educational world of the importance of the Polar Regions and to climate change by offering adapted educational tools and projects.

ENERGY

www.economie.fgov.be

The website of the Federal Public Service Economy, SMEs, Self-employed and Energy provides information about its areas of competence related to energy, including renewable energy (technologies, actors, financial regulations, legislation, statistics, links, etc.).

www.energivores.be / www.energievreters.be

This website carries a calculator module for detecting energy-guzzlers at home and above all for not letting new ones enter there by purchasing exclusively energy-efficient equipment or insulation materials. The module calculates their energy consumption or heat losses, the associated CO_2 emissions and financial costs, pay-back time, subsidies etc. It also hosts an electronic CO_2 guide for cars.

www.energiesparen.be

This website of the Flemish Energy Agency (VEA) provides information – under different headings for specific target groups - about all matters linked to energy: policy, rational energy use, statistics, subsidies, environmentally-friendly energy production, etc. Brochures on rational energy use (insulation, ventilation, heating, low-energy construction, practical advice, etc.) and sustainable energy (biomass, combined heat and power, solar energy, heat pumps, etc.) can be downloaded.

www.emis.vito.be

EMIS, the *Information System on Energy and the Environment,* is a project of the Flemish Region. This system collects and processes a wide range of information about energy and the environment which it divides into 4 major categories: energy numbers, guide to enterprises, environmental technology and legislation.

www.homegrade.brussels

In the Brussels Capital Region, Homegrade manages an information desk which provides advice to the general public on possibilities for saving energy and recourse to renewable energy. It also offers residential energy audits free of charge.

www.brugel.be

BRUGEL (standing for BRUxelles Gaz ELectricité/ Brussels Gas and Electricity) is the regulator of the energy market in the Brussels Capital Region. Its tasks include advising the public authorities on the organisation and operation of the regional energy market, verification of application of legislation and providing general information to the public.

www.ecolezerowatt.be / www.generationzerowatt.be

Website of the project "Génération Zéro-Watt", pioneering energy challenges in primary schools following a proven pedagogic methodology (in French and in German).

http://energie.wallonie.be/

This website of the Walloon administration in charge of energy provides extensive information about energy: policy, energy offices, energy saving and building renovation methods and subsidies, brochures, specialised manuals, etc.

www.topten.be

This website allows the most energy-efficient products to be found quickly and easily for homes and offices. It offers an overview for a whole series of products (domestic appliances, lighting, cars, circulation pumps, printers, PC and TV screens) of the most economical models on the Belgian market. It also provides an overview of the suppliers of green electricity.

www.apere.org

This website of the 'Association for the promotion of renewable energy' (Association pour la Promotion des Energies Renouvelables) provides information about the different renewable sources and their production in Belgium, as well as its projects, campaigns and educational activities promoting renewable energy, clustered in four fields: Prosumers, Cooperatives, Territories and Observatory.

www.ode.be

The *Organisation for Sustainable Energy* (Organisatie voor Duurzame Energie - ODE) is the central vector of information on renewable energy in Flanders to both households and companies. It has a permanent secretariat open to the public, publishes brochures and monitors the share of renewable energy in overall energy consumption in Flanders.

BUILDINGS

www.portailconstructiondurable.be / www.portaalduurzaambouwen.be

Website centralizing information about sustainable building, intended for construction professionals.

www.guidebatimentdurable.brussels / www.gidsduurzamegebouwen.brussels

Practical support developed by Brussels Environment with assistance of specialised offices, intended to professionnals willing to design a sustainable building or to perform a sustainable renovation of an existing building.

www.beexemplary.brussels

Call for projects to design and construct exemplary buildings in terms of energy and the environment, which is receiving increasing international acclaim.

www.bbri.be / www.wtcb.be / www.cstc.be

This website of the Belgian Building Research Institute provides information on legislation, regulations, subsidies and the procedures to be followed in the matter of thermic insulation and ventilation of buildings.

MOBILITY

www.mobilit.fgov.be

The site of the Federal Public Service Mobility and Transport explains how the issue of mobility fits into the federal policy on sustainable development. It also allows the level of CO_2 emissions of various models of vehicles to be checked.

http://statbel.fgov.be

The portal of the *National Institute of Statistics* offers all studies, numbers and statistics linked to traffic and mobility. See in particular the sections on 'mobility and the environment' and 'climate and the greenhouse effect'.

www.mobielvlaanderen.be

This Flemish Region site informs the population about various aspects of the mobility issue: a lot of information about

the possibilities of public transport, freight traffic, home-workplace trips, the mobility policy at the various levels of government, statistics, etc.

www.mobielbrussel.irisnet.be / www.bruxellesmobilite.irisnet.be

Brussels Mobility (AED - Administration for Equipment and Travel of the Brussels Capital Region) is in charge of the road network and public transport infrastructure in the Brussels Region. Its objectives include a.o. improving mobility, promoting public transport and integrating all users into the travel policy.

www.bikeexperience.be

The Bike Experience campaign raises awareness and encourages the staff of Brussels businesses to come to work by bike, by borrowing bikes and by offering the possibility to those who are not yet acquainted with cycling in town, to receive assistance from a coach who accompanies them and gives them good advice for a few days.

http://mobilite.wallonie.be

Site used by the Walloon Region to publicise its policy on mobility and to inform the public about all mobility-related topics.

www.ecoscore.be

The method of Ecoscore allows you to measure the environmental score of vehicles of all brands. It gives an indication of the overall environmental performance of your vehicle or of the vehicle you want to buy.

www.lez.brussels

This website provides information about the Low Emission Zone in Brussels.

www.mobilite-entreprise.be

This website of the Mobility Unit of the UWE, the Walloon Union of Enterprises, provides information on company mobility plans, the various means of transport, the role of 'mobility' coordinators within enterprises, tele-working, etc.

ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

www.vmm.be

The *VMM* (Flemish Environment Agency) is one of the public administrations in charge of designing and adapting environmental policy in the Flemish Region. It also reports on the quality of the environment in general and on air and water in particular.

www.irceline.be

The website of the Belgian Interregional Environment Agency (IRCEL-CELINE) provides information about the quality of ambient air in the country's regions and a daily ozone bulletin based on information gathered in various measuring stations, as well as on data archives.

www.environnement.brussels / www.leefmilieu.brussels

This is the website of Brussels Environment, the administration for the environment and energy of the Brussels Capital Region. It provides information on all environmental topics and on the actions of the Brussels Region in this field.

www.reseauquartiersdurables.be / www.participatieveduurzamewijken.be

A participative internet platform facilitating exchanges of experience and contacts between the sustainable neighbourhoods of the Brussels Capital Region.

http://environnement.wallonie.be

This is the portal of the Walloon Region for environmental questions. The 'Analytical Report on the State of the Walloon Environment' and the 'Walloon Environment Scoreboard' published each year include a specific chapter relating to climate change.

MAIN EDUCATIONAL ACTORS AND NETWORKS

www.klimaat.be/educatie / www.climat.be/education

Webpage describing the educational climate related activities and materials developed by the federal Climate Change Service in collaboration with different project partners.

www.mosvlaanderen.be

Milieuzorg Op School (Environmental care at school) is a network of the Flemish authorities, assisting schools to create an environmentally friendly and sustainable environment.

www.bubble.brussels

Bubble is a network of schools in action for the environment in the Brussels Region, enabling active teachers to share and exchange their practice and experience.

www.reseau-idee.be

The 'Idea Network' (NGO) has 120 member associations and is the main information centre for nature and environmental education within the Brussels Region and the Walloon region.

www.coren.be

COREN (Coordination Environnement) is an NGO developing environmental projects and programmes in the schools of the Brussels Region and the Walloon region.

www.crie.be

Network of 11 regional environmental initiation centres in the Walloon Region, providing school animations, training courses, activities for families and holiday courses.

www.wwf.be/school / www.wwf.be/ecole

The NGO WWF developed several climate related educational activities and materials for schools.

www.goodplanet.be/goodplanetactions

The NGO GoodPlanet organizes several climate related actions in schools and acts as a network for schools in the Brussels Region and in the Walloon Region.

The authors of the participative audits and of sensitisation actions to renewable energy:

– Emprunte asbl
http://www.empreintes.be

– Science Infuse
https://uclouvain.be/fr/decouvrir/scinfuse

– Hypothèse
http://www.hypothese.be

– La Besace
http://www.besace.be

Annexes

Annex 1. Supplementary information under Article 7(2) of the Kyoto Protocol – Correlation table

Information reported under Article 7(2)	Chapter of the 7th National Communication
National systems pursuant to Article 5(1)	3.3
National registry	3.4
Supplementarity relating to mechanisms under articles 6, 12 and 17	5.3
Policies and measures pursuant to Article 2	4.3
Domestic and regional program; legislative arrangements, enforcement and administrative procedures	4.2
Information under Article 10 Article 10a Article 10b Article 10c Article 10d Article 10e	 3.3 4.3 & 6.3 7.3 8 9.2 & 9.3
Financial resources	7.2

Annex 2. 3rd biennial report

1. Preamble

This Annex 2 to the Belgium's 7th National Communication under the UNFCCC is the 3rd Biennial Report of Belgium under decision 2/CP.17 of the Conference of the Parties under the UNFCCC. In line with UNFCCC biennial reporting guidelines for developed-country Parties, the information is structured as follows:

- information on greenhouse gases (GHG) emissions and trends (Section 2);
- quantified economy-wide emission reduction target (Section 3);
- progress towards the achievement of quantified economy-wide emission reduction targets (Section 4);
- projections (Section 5);
- provision of financial, technological and capacity building support to developing-country Parties (Section 6);
- other reporting matters (Section 7).

As requested (Decision 19/CP.18 - Document: FCCC/CP/2012/8/Add.3), the Common Tabular Format (CTF) has also been input into the BR-CTF electronic reporting application.

Tabular information as defined in the common tabular format (CTF) for the UNFCCC biennial reporting guidelines for developed country Parties (UNFCCC decision 19/CP.18) have been submitted to the UNFCCC through the electronic reporting facility provided by the UNFCCC Secretariat as required by UNFCCC decision 19/CP.18.

2. Information on greenhouse gas emissions and trends

2.1. Summary information on GHG emission trends

Belgium reduced its total GHG emissions between 1990 and 2015 by 19.7%. These emissions amounted 117.4 Mt eq. CO_2 in 2015 (excluding LULUCF) and 115.2 Mt eq. CO_2 (including LULUCF).

For further information on emissions trends, please refer to Chapter 3.2 and CTF Table 1.

2.2. National inventory arrangements

National inventory system is detailed under Chapter 3.3. No change has occurred since the 6th Belgian National Communication and 2nd Biennial Report.

3. Quantified economy wide emission reduction target

Under the Kyoto Protocol, a single European Union Kyoto Protocol reduction target for greenhouse gas emissions of -8% compared to base-year levels was negotiated for the first commitment period, and a Burden Sharing Agreement allocated the target between Member States of the European Union. Under this agreement, the Belgian quantified emission limitation was 92.5% on base-year levels. Belgium overachieved its commitments for the first commitment period of the Kyoto Protocol from 2008 to 2012, reducing its emissions (expressed on an annual basis) by 13.9% compared to the base year.

For the second commitment period of the Kyoto Protocol (2013 to 2020), the EU and its member States (together with Iceland) agreed to jointly meet a 20% reduction target compared to 1990 1990 levels (base year). The target for the European Union and its Member States is based on the understanding that it will be fulfilled jointly with the European Union and its Member States. The 20% emission reduction target by 2020 is unconditional and supported by legislation in place since 2009 (Effort Sharing Decision EC/406/2009). Under this decision, Belgium has a commitment of -15% compared to 2005 for the non-ETS sector. Belgium is in compliance with this objective for the 3 first years of the period.

In 2010, the EU submitted a pledge to reduce its GHG emissions by 20% by 2020, compared with 1990 levels in order to limit the global temperature increase to less than 2°C above pre industrial period (FCCC/CP/2010/7/Add.1). The EU had also committed to raising this target to a 30% emission reduction by 2020 compared with 1990 levels, provided that other developed countries also commit to achieving comparable emission reductions, and that developing countries contribute adequately, according to their responsibilities and respective capabilities. This offer was reiterated in the submission to the UNFCCC by the EU-28 and Iceland on 30 April 2014[1].

The definition of the Convention target for 2020 is documented in the revised note provided by the UNFCCC Secretariat on the 'Compilation of economy-wide emission reduction targets to be implemented by Parties included in Annex I to the Convention' (FCCC/SB/2011/INF.1/Rev.1 of 7 June 2011). In addition, the EU provided additional information relating to its quantified economy wide emission reduction target in a submission as part of the process of clarifying the developed country Parties' targets in 2012 (FCCC/AWGLCA/2012/MISC.1).

The EU clarified that accounting rules for its target under the UNFCC are more ambitious than the current rules under the Kyoto Protocol, for example, including international aviation, and adding an annual compliance cycle for emissions under the Effort Sharing Decision or higher Clean Development Mechanism quality standards under the EU Emissions Trading System). Accordingly, the following assumptions and conditions apply to the EU's 20% target under the UNFCCC:

- The EU Convention pledge does not include emissions/removals from Land Use, Land Use Change and Forestry, but it is estimated to be a net sink over the relevant period. EU inventories also include information on emissions and removals from LULUCF in accordance with relevant reporting commitments under the UNFCCC. Accounting for LULUCF activities only takes place under the Kyoto Protocol.
- The target covers the gases CO_2, CH_4, N_2O, HFCs, PFCs and SF_6.
- The target refers to 1990 as a single base year for all covered gases and all Member States. Emissions from international aviation to the extent it is included in the EU ETS are included in the target[2].
- A limited number of CERs, ERUs and units from new market-based mechanisms may be used to achieve the target: in the ETS, the use of international credits is capped (up to 50% of the reduction required from EU ETS sectors by 2020). Quality standards also apply to the use of international credits in the EU ETS, including a ban on credits from LULUCF projects and certain industrial gas projects. In the ESD sectors, the annual use of international credits is limited to up to 3% of each Member State's ESD emissions in 2005, with a limited number of Member States being permitted to use an additional 1% from projects in Least Developed Countries or Small Island Developing States, subject to conditions.
- The Global Warming Potentials used to aggregate GHG emissions up to 2020 under EU legislation were those based on the Second Assessment Report of the IPCC when the target was submitted. In accordance with the CMP Decision to revise the GWPs to those from the IPCC Fourth Assessment Report revised GWPs from AR4 were adopt-

[1] European Union, its Member States and Iceland submission pursuant to par 9 of decision 1/CMP.8".

[2] In the EU, the sum of emissions covered by categories 1.A.3.a 'domestic aviation' and memo item 'international bunkers - aviation' go beyond the scope of the EU target, as emissions from international aviation are included in the EU Climate and Energy Package and the EU target under the UNFCCC to the extent to which aviation is part of the EU ETS.

ed for the EU ETS. The revised GWPs were taken into account for the revision of the ESD target. For the implementation until 2020, GWPs from AR4 will be used consistently with the UNFCCC reporting guidelines for GHG inventories.

Description of national targets is provided in Chapter 4.1.2.

Description of the quantified economy wide emission reduction target is provided in CTF Table 2.

For more information on the implementation architecture, we refer to chapter 3.1.2 of the 2nd Belgian Biennial report.

Detailed information on the EU target compliance architecture as well as an overview table of EU targets (international commitments and EU domestic legislation) can be found in section 3 of the 3rd Biennial report of the EU.

Table A: Key facts of the Convention target of the EU-28

Parameters	Target
Base Year	1990
Target Year	2020
Emissions Reduction target	-20 % in 2020 compared to 1990
Gases covered	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6
Global Warming Potential	AR4
Sectors Covered	All IPCC sources and sectors, as measured by the full annual inventory, international aviation to the extent it is included in the EU ETS
Land Use, Land-Use Change, and Forestry (LULUCF)	Excluded
Use of Flexible Mechanisms	Possible to a certain extent under the EU ETS and the ESD
Other	Conditional offer to move to a 30 % reduction by 2020 compared to 1990 levels as part of a global and comprehensive agreement for the period beyond 2012, provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities.

4. Progress with achievement of quantified economy wide emission reduction targets and relevant information

4.1. Mitigation actions and their effects

Description of policy making process is provided in Chapter 4.1.

Description of domestic and regional programs, legislative arrangements, enforcement and administrative procedure is provided in Chapter 4.2.

Description of mitigation policies and measures and their effects is provided in Chapter 4.3.

Information on mitigation actions and their effects on the achievement of the quantified economy wide emissions reduction target is provided in CTF table 3.

Table B gives these estimates of the impact of the 4 main areas of action: electricity generation, buildings, industry and transport.

4.2. Estimates of emission reductions and removals and the use of units from the market-based mechanisms and land-use change and forestry activities

The development of GHG emissions is reported in CTF Table 4 for Belgium. As a KP Party, Belgium supplemented Table 4(a)II in its 2018 submission, but not Table 4(a)I.

Table B: Impact of the measures per cluster

Field of action		Clusters of measures		Estimate of mitigation impact (2020)
				kt eq CO_2
EP	Energy production and conversion	EP-A	Environmentally friendly energy production	7775.63
		EP-B	Energy efficient electricity production	4526.01
EC	Energy conservation in buildings	EC-A	Cross-cutting issues	7017.69
		EC-B	Residential sector	572.03
		EC-C(*)	Tertiary sector	391.69
IP	Reduce industrial emissions	IP-A	Energy efficiency in industry	3267.22
		IP-B	Reduce F-gases emissions	1647.00
		IP-C	Reduce N_2O emissions in industrial processes	3362.21
TR	Sustainable transport	TR-A	Promote the intermodality of transport means	495.15
		TR-B	Improve transport efficiency	178.08
		TR-C	Promoting environmentally friendly vehicles	11.56
		TR-D	Promoting biofuels	3264.00
Varia				4189.54
Total				**36697.81**

Figures on the use of market mechanisms in CTF Table 4 relate exclusively to the Belgian part of the EU target.

In general, in the EU, the use of flexible mechanisms can take place on the one hand by operators in the EU ETS, on the other hand by governments for the achievement of ESD targets. For information on the limits and the types of international credits that can be used under the ETS and under the ESD, please see Chapter 5.3 of NC7. For information on the use in the ETS please see the 3rd BR of the European Union.

CTF Tables 4 and 4(b) show that the remaining units needed to fulfill the BE commitments under the first commitment period (CP1) of the Kyoto Protocol, have been withdrawn in the year 2015 during the additional period for fulfilling commitments (true-up period). For further information on those numbers, please see Chapter 5.3 of NC7.

At present, the use of flexible mechanisms under the ESD can only be quantified for the year 2013. Indeed, the compliance assessment for the first year under the ESD (2013) only took place in 2016-2017, and the 2014 cycle still is ongoing. During 2013, under the ESD, no flexible mechanisms were used by Belgium. For further information, please see Chapter 5.3 of NC7.

5. Projections

Information on projections are provided in Chapter 5.

Summary of key variables and assumptions used in the projections is provided in CTF Table 5.

Information on updated greenhouse gas projections is provided in CTF Table 6a. Belgium did not provide Table 6b and 6c as no 'without measures' scenario and no 'WAM' scenarios are available.

6. Provision of financial, technological and capacity-building support to developing-country Parties

Over the period 2015-2016, Belgium provided 148 million EUR of public support to developing country Parties (see CTF Tables 7, 8 and 9), mainly through grants and some concessional loans. This financial, technological and capacity-building support to non-Annex I Parties mainly focused on:

- Predominantly adaptation and cross-cutting activities;
- Provision of bilateral and multilateral support under the form of grants;
- Contributions mainly directed towards Africa and Least Developed Countries (LDCs);
- Contributions to climate-specific multilateral funds (Green Climate Fund, Adaptation Fund, Least Developed Countries Fund, etc.) or specialized UN agencies;
- Mainly in the following sectors: multisectoral, agriculture and livestock, energy, water and sanitation and environment

At the Conference of the Parties in December 2015, Belgium announced that it would contribute at least 50 million EUR yearly to international climate finance. According to a negotiated internal distribution ratio the federal government accounts for half of this yearly commitment. The regions provide the other half as follows: 14.5 million EUR by the Flemish region, 8.25 million EUR by the Walloon region and 2.25 million EUR by the Brussels Capital region[3].

Legislative and institutional framework of climate change policies and programmes

See also Chapter 7.1.

Regarding the contribution to international climate finance, an internal distribution ratio is agreed to meet Belgium's announcement to contribute annually EUR 50 million in 2016-2020:

- Federal government: EUR 25 million
- Government of Flanders: EUR 14.5 million
- Government of Wallonia: EUR 8.25 million
- Government of Brussels-Capital Region: EUR 2.25 million

[3] More information on the Belgian burden-sharing agreement are available on the website of the National Climate Commission.

Provision of international climate finance through official Development Assistance and Other Official Flows

Belgian climate finance in 2015-2016 focuses on adaptation and crosscutting activities, with 53 % and 33 % respectively, as presented in the Figures A, B, C and D.

Programmes and projects are mainly developed in the following sectors: agriculture and livestock, environment energy and water and sanitation. The large share of funds labeled as multisectoral is mainly due to a large part of finance contributed to multilateral financial instruments. An overview can be seen in the figures below.

Figure A: Belgian climate finance-type of support (2015-2016)

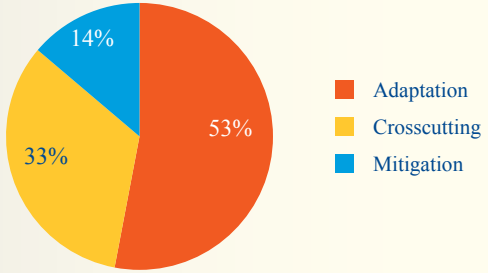


Figure B: Belgian Climate Finance per sector – category other includes: climate policy, support to civil society, rural development, public sector, education, agriculture and food security, health, transport, forestry, fisheries and others

Figure C: Contribution to international climate finance - federal and regional governments (2015-2016)

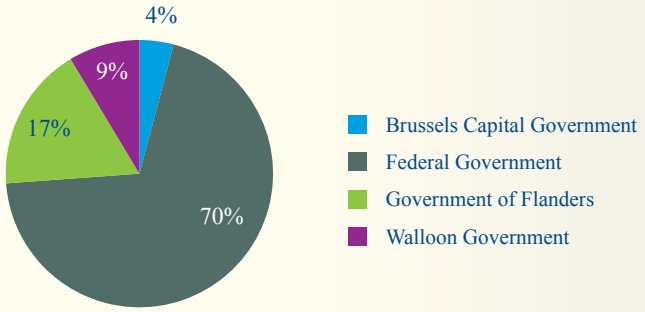
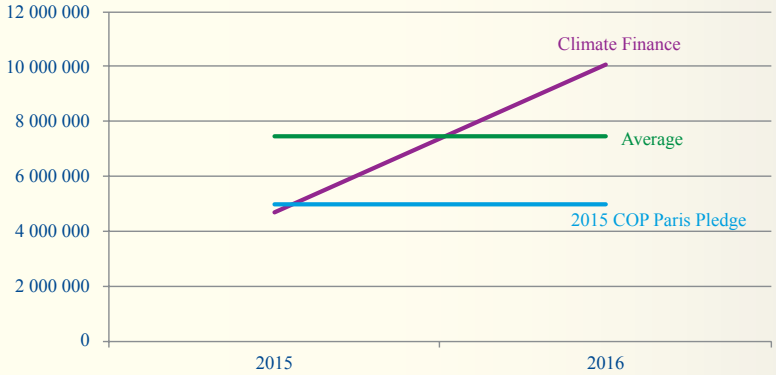


Figure D: Belgian contribution to International Climate Finance- per year



Financial contributions to multilateral institutions and programmes

See also Chapter 7.2.1.

In total Belgium provided climate finance of 60.8 million EUR to several funds and organization in 2015-2016. (see Figure E). Overview of contributions to multilateral funds in 2015-2016).

Figure E: Main Belgium: Multilateral Climate Finance per organization/fund (2015-2016)

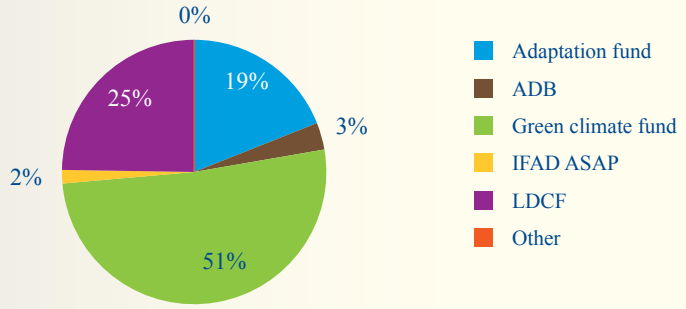


Table C: Contributions to the Global Environment Facility

Contributions to the Global Environment Facility (in EUR)	2015	2016
GEF Trust Fund	18 600 000	18 600 000
Least Developed Countries Fund	0	15 000 000
Special Cimate Change Fund	0	0

Federal Government

In 2016 new Framework Arrangements were signed between the federal government and its 15 multilateral partner organizations. These FA's are used to underline the commitment to work jointly to implement the 2030 Agenda for Sustainable Development and as a basis for long term cooperation.

During 2015-2016, Belgium provided 18.6 million EUR yearly to the Global Environment Facility, an operating entity of the financial mechanism under the UNFCCC. This contribution is also un-earmarked.

In addition to the provision of these core resources, within the available resources for development cooperation, a significant part of the multilateral finance was specifically targeting multilateral climate change funds. See also Chapter 7.

Government of Flanders

See also Chapter 7.

The Government of Flanders has contributed to the Green Climate Fund (3.5 million EUR in 2015 and 6.25 million EUR in 2016).

The Government of Flanders also provided support through the Adaptation Fund (6.25 million EUR in 2016), which finances projects and programmes that help vulnerable communities in developing countries adapt to climate change.

2 million EUR are disbursed in the African Climate Change Fund (ACCF). The ACCF, managed by the African Development Bank (AfDB), provides technical assistance to African countries to access international climate finance.

Government of Wallonia

The Government of Wallonia has provided financial contributions to **Green Climate Fund** (1.374 million EUR in 2015 and 7 million EUR in 2016) in order to finance adaptation and mitigation projects.

The government of Wallonia has also made contributions to the Adaptation Fund (250 000 EUR in 2015 and 1 million EUR in 2016) to support its projects and programmes, which play an important role in achieving the Paris Agreement objectives.

Government of the Brussels-Capital Region

The Government of the Brussels-Capital Region has contributed to provide climate finance to the Green Climate Fund (500 000 EUR in 2015).

As from 2016, an internal burden sharing distribution of the Belgian climate finance international commitments has required the Government of the Brussels-Capital Region to provide 11 250 000 EUR to climate finance for the years 2016-2020. The Government of the Brussels-Capital Region has disbursed by now new and additional financial contributions to the Adaptation Fund (2 500 000 EUR in 2016) and to the Green Climate Fund (2 500 000 EUR in 2016) for this period.

Figure F: Top 20 of recipient countries of Belgian bilateral climate finance in 2015-2016 (in EUR)

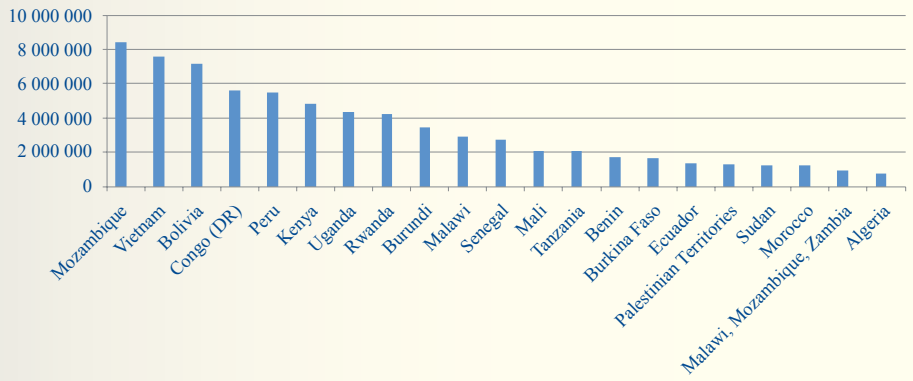
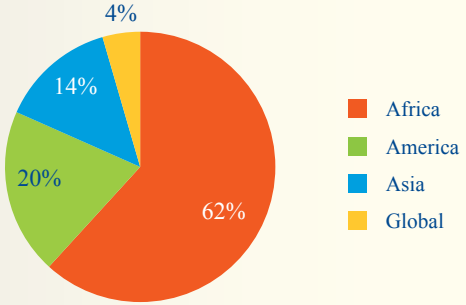


Figure G: Bilateral Climate Finance: distribution per region (2015-2016)



Bilateral and Regional Financial Contributions

See also Chapter 7.

A top 20 of recipient countries can be seen in Figure F.

Federal Government

In 2015, Belgium renewed its list of partner countries and decided to focus most of its support on 14 countries: Benin, Burkina Faso, Burundi, DR Congo, Guinea, Mali, Morocco, Mozambique, Niger, Palestinian territories, Rwanda, Senegal, Tanzania and Uganda.

In parallel to the bilateral support provided to these 14 countries, Belgium also supports civil society organizations that operate in a wider range of developing countries.

In the reporting period bilateral finance provided by the federal government amounted to 76.5 million EUR.

The federal government aims to direct 50% of its ODA towards Least Developed Countries. Bilateral climate finance by the federal government reflects this policy towards Least Developed Countries in Africa. 52% of bilateral climate finance is directed towards activities in LDC's in the period 2015-2016, which reflects an increasing trend.

The Belgian Investment Company for Development Cooperation (BIO) is another important actor in providing funds for climate investments. Their climate portfolio mainly consists of projects in the renewable energy sector, mostly by providing loans and equity. Its overall portfolio for 2015-2016 represented commitments of 223 million EUR, of which 23% can be considered climate finance.

See also Chapter 7.2.

Government of Flanders

See Chapter 7.2.

Government of Wallonia

See Chapter 7.2.

Government of the Brussels-Capital Region

See Chapter 7.2.

Table D: Climate Finance investments by BIO 2013-2016 (net commitments excluding exits)

year	Total net commitments (EUR)	Climate Finance (EUR)	%
2015	84 236 622	1 000 000	1.2
2016	138 862 133	49 984 500	3.6
Total	**223 098 755**	**50 984 500**	**23%**

Activities relating to transfer of and access to technologies and capacity building

An overview of activities related to technology transfer and capacity building can be found in the CTF Tables 8 and 9.

See also Chapter 7.3.

Mobilization of Private Sector support through public intervention

In addition to playing its part in providing public climate finance, Belgium is directing its efforts towards mobilizing flows of private finance for climate-related projects in developing countries, as this it is pivotal to achieving long-term transformation of developing countries into low-carbon and climate-resilient economies.

Actors and Channels to mobilize private sector support

See Chapter 7.4.1.

Efforts to improve the tracking and reporting of mobilized private climate finance

See Chapter 7.4.2.

Methodological Approach for tracking of the provision of financial, technological and capacity-building support to non-Annex I Parties

See Chapter 7.5.

7. Other reporting matters

Belgium's domestic arrangements related to self-assessment of compliance with emission reduction commitments at European and international levels, as well as the establishment of national rules for taking local action against domestic non-compliance with emission reduction targets, including:

- The mechanism for increasing awareness of climate responsibility among the Regions for the building sector (see Chapter 4.2.1.3).
- A substitution right for international obligations under the UNFCCC and its Protocols (see Chapter 4.2.1.4).
- The cooperation agreement between the Federal state and the three regions on the burden sharing for 2013-2020 climate and energy goals (non-ETS targets as well as the share of renewable energies). As soon as it has been approved by the four parliaments, this cooperation agreement will provide the legal basis for the decisions to be taken to respect the commitments entered into by Belgium under the European Energy & Climate Package. Section 6 of this cooperation agreement addresses regional and federal compliance rules, a.o. the possibility for the Regions to use credits, the provision of financial compensation by the Federal level to the Regions.

Annex 3. Description of models used

I. Flemish energy and greenhouse gas simulation model

A new Flemish simulation model has been developed in 2014 (and is continuously updated since) to construct short term projections for Flanders.

The simulation model is a projection model for energy demand, greenhouse gas emissions and emissions of air pollutants (SO_2, NO_x, PM and VOC) that covers most of the relevant emission sectors (energy sector, industry, waste, agriculture, residential and commercial buildings).

This simulation model works as a "bottom-up" type, i.e. explaining energy consumptions and emissions from activity variables expressed as far as possible in physical units, and the main determining factors of the evolution of energy demand and emissions.

The model, which includes a database on the energy consumption, emission factors, activity data and reduction effects of climate & energy and air quality policy measures, can be 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 based on expected economic and demographic evolutions;
- constructing emission reduction scenarios, based on the implementation of a combination of reduction measures;
- assessing the impact of existing or draft legislations on energy consumption and emission levels.

The model starts from reference year data:

- energy demand per industrial sector;
- emissions per industrial sector;
- large combustion plants and all electricity producing plants are included at installation level (energy consumption, electricity production and emissions);
- detailed information on the evolution of the installed power for electricity generation (including electricity import);
- a representation of the structure of residential heating (type and age) and of residences (idem for the heating of tertiary buildings).
- Share of the emissions, per sector, issuing from processes (and therefore not related to fuel consumption).
- For the agricultural emissions (dust, greenhouse gasses and ammonia emissions from stables and manure), the starting point is the number of animals (detailed per animal category and per type of stable) and the amount of manure that is spread out.

For the residential sector, projections are driven by assumptions on degree days in the future, the share of new residences and the lifetime of existing installations. Policies on energy efficiency and ecodesign are taken into account.

For industry, major assumptions are the evolution of industrial activity and energy efficiency (yearly growth rate per sector), the share of CHP per sector and the lifetime of installations (as new installations can mostly respect lower emission levels than existing ones). This leads to a projection on energy consumption and electricity.

Electricity demand from all sectors (including transport) is the main driver for the electricity part of the model. The model searches for the most cost optimal mix of electricity generating installations (including import) to produce the necessary electricity, taking into account different time slices (electricity demand is not equal in winter and in summer, neither during night or day), based on production efficiencies and fuel cost. The model offers the possibility to install additional production capacity (CCGT or gas turbine).

For all energy consuming sectors, energy consumption is translated into emission projections through emission factors (per fuel) that reflect policy (either current policy or additional measures). For industry and electricity production, current emission factors are compared to the emission factors based on policy and the lowest of both is used (installations that already comply with future emission standards don't need to achieve additional reductions). For the residential sector, the emission factors take into account the use of different types of boilers and stoves.

For the agricultural sector, the predicted number of animals is multiplied with animal specific emission factors (for both greenhouse gases and for ammonia and dust). These emission factors are lower for the new low emission stables. Also the amount of manure that is spread out is multiplied with specific emission factors.

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 within the framework of a number of studies performed for public authorities at boththe regional and the 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. dinstinct evolutions according to sub-sectors if 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 based 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, NO_x 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 more in detail than the others. For example, iron & steel production is taken into account according to the given process (agglomeration, blast furnace, oxygen steel production…); for the chemical industry about twenty basic products are distinguished.

In the residential sector we consider 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 size and the thermal characteristics are comprehensively 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 surface area of buildings.

In the transportation sector, the distinction is made 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 subdivided according to the energy use (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 ton 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 than 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 equipment, which naturally lead 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, fans, 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 CO_2, 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 or 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 calcu-

late 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 account 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. Energy and Atmospheric Emissions projection model for Brussels Capital Region

Brussels Environment has developed its own projection model for energy demand and atmospheric emissions from stationary sources (residential, tertiary, industry and heat and electricity sector). The horizon of the projections is 2030, after this year extrapolation for each sector has been done in order to estimate emissions for 2035.

As a 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)
- renovation rate, improvement of energy efficiency expected in case of renovation and new constructions. This improvement depends on the typology of building stock composed of 140 type-dwellings: apartment or house, 5 age range of the building concerned, the 7 energy carriers used for heating, and the heating system installed (central or decentralized).

The model has been calibrated for each sector with the regional annual energy balances from 2000 to 2013. The modelled energy consumptions have then been converted into atmospheric emissions through emission factors, the ones used to establish the emission inventories.

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 aenesthesia and aerosols, the emissions from the decomposition of organic matter (composting plant, water purification plant).

This is a dynamic model. 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…).

IV. Transport Emission Projection model for the Brussels-Capital Region

The model distinguishes between road, railways and waterways transport. The projections horizon is 2030.

The calculation of atmospheric pollutants emissions and fuels consumption for road transport is based on the European COPERT IV approach. The main input data required for COPERT simulations (vehicles fleet and mobility) comes from a regional transport model, developed on the basis of literature data (TREMOVE projections *(9)* and INRETS study *(10)*), and recalibrated to the actual situation in the Brussels Region using emission inventories and outputs from a detailed traffic model (MUSTI).

Pollutant emission calculations with COPERT have been performed using the same software version and hypotheses as for the UNFCCC 2015 GHG inventory preparation. Fuel consumptions are detailed for gasoline, diesel, LPG and CNG. In Belgium, biofuels are mixed with gasoline and diesel in public fuel tank stations (blends). The CO_2 emissions from the biogenic part of fuels (bioethanol or biodiesel) are calculated in post-treatment, on the basis of the composition of blends, which may vary from year to year.

For railways, the evolution of liquid fuel (gasoil) consumption is derived from the evolution of freight transport demand (FPB, 2014). Pollutant emissions are calculated by combining fuel consumptions with emission factors from IPCC 2006 Guidelines for national emission inventories[4]. Passenger transport (trains, metro and tramways) is driven by electricity; the transport supply (and the corresponding electricity consumption) increases by 70 % between 2012 and 2025, together with the expected finalization of the express regional network (RER, French acronym).

For inland navigation, the evolution of liquid fuel (gasoil) consumption is derived from a reference scenario of transport demand for Belgium (FPB, 2014). The 2014 value (starting point of the projections) comes from the regional energy balance. Pollutants emissions are calculated by combining fuel consumptions with emission factors from IPCC 2006 Guidelines for national emission inventories[5].

For off-road transport, the OFFREM model is used at regional scale by the 3 Regions in Belgium.

[4] http://www.ipcc-nggip.iges.or.jp/public/2006gl/
[5] http://www.ipcc-nggip.iges.or.jp/public/2006gl/

V. Description of the Hermes-model

HERMES[6] is the macrosectoral model used by the FPB for its national medium-term outlook[7]. It fits in the tradition of annual econometric models based on time series analysis. The first year of an outlook is generally based on a short-term forecast made by means of MODTRIM, the FPB's quarterly model, whereas the subsequent years ought to be considered as a projection that outlines a possible future under the assumption of unchanged policies for the Belgian economy and highlights the economic imbalances that are likely to occur over a period of five to six years[8]. The medium-term outlook also analyses in detail the expected development of public finances, of the labour market as well as energy demand and greenhouse gas emissions.

HERMES is also used for scenario analyses in order to determine the impact of some shocks (e.g. on oil prices or on export markets' growth) or policy measures (at an economic and social level) on economic growth, employment, public finances, sectoral indicators, energy demand and greenhouse gas emissions.

The current version of HERMES contains about 8 000 equations (of which 600 behavioural equations) and more than 1 200 exogenous variables (see Table E). The model's size is mainly a consequence of breaking down the economy in 15 industries. 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 industries have been extensively modelled, using 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. The energy module is also very detailed. Aggregate energy demand of each economic agent (firms, government, households) is computed and allocated between 6 main energy products; energy production is also modelled.

[6] More information about the HERMES model can be found in "A new version of the HERMES model – HERMES III", Working Paper 13-13, Federal Planning Bureau, November 2013.
[7] Once a year, usually in May or June, the FPB publishes a medium-term macrosectoral outlook. Since 2014, the FPB also produces a brief provisional version of this outlook in March as a contribution to the preparation of the Stability Programme and the National Reform Programme that have to be submitted to the European Commission in April.
[8] See e.g. "Perspectives économiques 2016-2021– Economische vooruitzichten 2016-2021", Federal Planning Bureau, June 2016.

Table E: Main characteristics of HERMES

Industries
Agriculture
Energy
Intermediary goods
Equipment goods
Consumption goods
Construction
Transports and communications
- Rail and road transportation
- Air, maritime and fluvial transportation
- Other transport services and communication
Trade, lodging and catering services
Services of credit and insurance institutions
Health care
Other services to households and firms
Public administrations and education
Other non-market services

Energy and environment
Coal
Coke
Crude oil
Petroleum products
- Gas/diesel oil
- Residual fuel oil
- Motor spirit
- Diesel for transportation
-Jet fuels
Gasses
- Natural gas
- Derived gasses
- Coke oven gas
- Blast-furnace gas
Electricity
Other fuels
Renewables (biomass, wind energy, hydro energy, solar heat, etc.)

Greenhouse gasses
- CO_2 energetic
- CO_2 non-energetic
- CH_4
- N_2O
- HFC, PFC, SF_6 and NF_3

Consumption categories
Food, beverages and tobacco
- Food
- Non alcoholic beverages
- Alcoholic beverages
- Tobacco
Clothing and footwear
Gross rent
Fuel for heating
- Solid fuels
- Liquid fuels
- Natural gas
Power
Domestic services
Furniture and household equipment
Personal transport equipment
Fuels for personal transport
- Motor spirit
- Diesel
- Others
Purchased transport
- Passenger transport by train, tram and underground
- Passenger transport by road
- Other transport services
Communication services
Medical care and health service
Recreation, education, culture
Other goods and services
Tourism abroad

Institutional sectors
Households
NPISH
Corporate enterprises
- Non financial corporate enterprises
- Credit institutions and insurance enterprises
General Government
- Federal government
- Regions and Communities
Brussels Region
Walloon Region
Flemish Region and Flemish Community
French Community
- Local authorities
- Social security fund
Rest of the world

- 8.000 equations (of which about 600 behavioural equations econometrically estimated)
- 1.200 exogenous variables (world trade, external prices, external interest rates, demography and labour supply, fiscal policy, etc.)
- 2.600 scalars (econometrically estimated parameters)
- 15 industries; 15 main consumption categories (total of 24); 6 main energy types (total of 14); 6 greenhouse gasses.
- 5 main institutional sectors (total of 12)
- Public administrations divided into 4 main entities (for a total of 7)

VI. Description of the OFFREM model

The off-road sector in the OFFREM model consists of ten categories: off-road machinery and off-road vehicles in agriculture, forestry, households, green area maintenance, industry, building, harbours, airports, multimodal transhipment and defence. The emission factors in OFFREM are based on the TREMOD model and the EMEP/CORINAIR Emission Inventory Guidebook. The emission factors take into account the legislation in the year of construction. The basic input consists of fleet information and activity numbers. The fleet information includes vehicle/machine type, fuel type, engine type, year of construction, technology and engine capacity. The fleet and activity information can be organised in different ways in different sectors. The output of the model calculations consists of emissions and energy use.

Projected off-road emissions are calculated separately and are included in the categories 1A2g (vii) manufacturing industry and construction, 1A3e (ii) other transportation (ports, airports and terminals), 1A4b (ii) residential, 1A4c (ii) agriculture, forestry & fishing and 1A5b other/mobile (defence). This is the same calculation and allocation method as used in the Belgian inventory (CRF Tables). For more detailed information we can also refer to the National Inventory Report.

VII. Description of the F-gas model

The projections are based on the emission inventory for 2013, taken as reference year, and on the same methodology as the emission inventory. They also use assumptions consistent with those of this inventory. All calculations have been performed by extrapolating the calculation models of the emission inventory, year by year, from 2013 up to 2030, which allows to take into account changes in parameters occurring between the 5 yearly projection years, as well as the dynamic aspects of yearly stock changes.

The calculation method is specific to each particular sector. All sectors of the emission inventory have been taken into account, even the smallest ones, which ensures complete consistency with the inventory. The future expected impact of EC-regulation 517/2014 is taken into account.

For the largest F-gas emission source for instance, the stationary refrigeration sector, assumptions have been made for the shares of refrigerants in new systems. These assumptions are based on studies carried out in France by Ademe and allow the emissions of installations to develop roughly in line with the phase-down of EC Regulation 517/2014.

Annex 4. Description of selected projects or programmes that promoted practicable steps to facilitate and/or finance the transfer of, or access to, environmentally-sound technologies

1. Name of project or programme

Improved cookstoves

Purpose:

The overall objective of the project was to reduce deforestation and land degradation by improving energy efficiency in households and promoting sustainable agricultural activities resilient to climate change around the protected reserves of northern Benin.

The specific objectives were:

1. Promoting an improved technology (FAE: Foyers Améliorés Erythréens – Improved Eritrean Cook stoves) to reduce the use of wood energy and consequently decrease CO_2 emissions;
2. Reduce the vulnerability of households living from the trade of wood by promoting family-friendly agricultural activities adapted to climate change;
3. Develop a carbon project to be brought to the carbon market while enhancing the capacities of local authorities on climate change and of the local team and local authorities on climate change and carbon finance.

Recipient Country
Benin
Sector
Energy efficiency, CO_2 reduction, Carbon project
Total Funding
346 721 EUR (273 533 EUR funded by Wallonia)
Years in operation
2013-2016

Achieved results:

1. 8.000 improved cook stoves are used by at least 3 500 households in 5 municipalities around the Pendjari National Park. The improved cook stoves needs 50 % less wood than the traditional 3 stones-cook stoves.
2. 387 additional improved cook stoves have been constructed outside the project area with the revenues from voluntary CO_2 compensations from tourism activities in the Pendjari National Park.
3. 267 households living from the trade of wood are investing in complementary demonstrative agricultural activities resilient to climate change.
4. A carbon project has been registered with an approved methodology and potential clients for the carbon credits have been identified. Carbon credits will continue to be generated and the revenues from the sale of these carbon credits will be reinvested for the maintenance of the existing cook stoves and the replacement of cook stoves after their life time.
5. The capacities of the local team and local authorities on climate change and on carbon finance have been reinforced.

=> As this project has been a success story, the Walloon region of Belgium decided in 2016 to approve a similar project, performed by the same project promoter, but in another area in northern Benin.

Indicate factors which led to project's success:

- The project proposal has been designed bottom-up. There was a real need for these cook stoves in the project area. The project perfectly fits in the priority needs for the country, defined in the PANA 1.
- The project area was well known by the project promotor.
- Since the very beginning, the local beneficiary population was very much involved in the different stages of the project: preliminary analysis, search for adapted improved cookstoves, experimentation, dissemination of techniques and good practices, monitoring and evaluation. This has led to a high degree of adoption of the proposed improved technology by the households in the project area as the cook stoves are adapted to the local needs and made of locally available materials that are also accessible for the poorest households.
- Strong awareness-raising campaigns were conducted among the beneficiary population, especially about the causes and risks of deforestation and the health problems related to the traditional cook stoves (smoke inhalation). The advantages of the proposed solution by improved cook stoves have been explained, all adapted to the local context.
- The local population very quickly noticed the direct impacts of the improved cook stoves, especially on the health of their family. This has also led to a high adoption degree of the proposed cook stoves.
- The design of the cook stoves has been studied in collaboration with a competent laboratory and has been corrected in order to achieve optimum energy efficiency.
- A very well organized, enthusiastic project field team was set up, was in very close con-

tact with the beneficiary population and assured a continuous follow-up 'on the field'.
- The implementation of the project has increased awareness and improved knowledge of stakeholders on the challenges of natural resource degradation in the Pendjari National Park and adaptation of communities to the effects of climate change.
- The local and national authorities were very enthusiastic about the project.
- For Benin, this project was the very first carbon project and so a pioneer project for the country. This has increased its visibility at regional and international level.
- The participation of the project promoter to different local events, the diffusion of a documentary film on the project activities and results and the share of experiences, have lead to an interest in the project from stakeholders at national level (in other towns) and regional levels (Togo and Nigeria).
- The local project promoter was assisted by a Belgian partner to elaborate the carbon project and search for potential clients interested in the purchase of the carbon credits. The knowledge of the Belgian partner was very useful as the set-up of a carbon project is quite complex, both on the procedural and the administrative level.
- The strict procedures of the carbon project-process, requested by Gold Standard, has led to a very good monitoring of the installed cook stoves and resulted in an organizational improvement of the project team and an improvement of the follow-up of the construction and the use of the improved cook stoves, in a professional database.

Technology transferred:

- *Improved cookstoves*
- *Carbon project (voluntary market)*

Impact on greenhouse gas emissions/sinks (optional)

- Estimated reduction of 10 000 t CO_2/year. Monitoring and verification is ongoing.

2. Project/programme title: Renewable energy in rural areas

Recipient Country
RWANDA
Sector
Energy
Total Funding
279 665 EUR AWAC/8 500 EUR private
Years in operation
2014-2017

Description:

Capacity building of local entrepreneurs with minimum experience in pico-hydro development who lacked expertise to conceive, implement and manage off grid projects efficiently, reliably and sustainably. Gathering these entrepreneurs under an umbrella group for off grid projects' development.

Indicate factors which led to project's success:

- Previous experience of the trainees
- Quality of the trainers (JLA Hydro, Belgium)

Technology transferred:

- Analysis and design of pico hydro power sites
- Manufacturing of equipment

Impact on greenhouse gas emissions/sinks (optional)

- Hydropower prevents the use of energy to produce electricity

3. Project/programme title: Construction and rehabilitation of schools in the Palestinian Territory

Purpose:

The Government of the Kingdom of Belgium has been involved in the sector of school construction in the occupied Palestinian territory (oPt) since 2003, with 4 consecutive phases – the first phase (School I - 5mi. EUR) was completed in 2010, the second (School II - 10 mi. EUR) ended in 2012, the third was finalized in 2014 (School III - 7mi. EUR), while the present phase, School IV, is under way, with a budget of 17.5 million EUR and a duration of five years. The objective of the program is to improve the access to education with the construction of new schools in the oPt. Since Phase III, the focus was on the construction quality and the experimentation of innovative techniques, especially on passive buildings.

Recipient Country
Palestinian Territory
Sector
Education/Infrastructure
Total Funding
School III: 7. Mi EUR School IV: 17.5 mi EUR
Years in operation
School III: 2010-2014 School IV: 2014-2019

Description:

This adaptation program builds on innovative practices to improve the learning condition of Palestinian children in West Bank. By improving the eco-design of the schools through the incorporation of environmental, cost effectiveness and users' comfort concepts, and harnessing geothermic and solar energy to make them cooler in summer and warmer in winter, this project improves the resilience of Palestinian schools and allows them to remain open all year long.

As part of the extension of the administrative buildings of the Ministry of Education and High Education (MoEHE), School III provided a PV installation of 7kW on the roof of the main Ministry building. A monitoring system was added to the installation, to measure and communicate the output of the system. Apart from bringing useful data to the MoEHE, this system displays energy consumption and production in realtime on a screen at the main entrance of the building, thereby raising awareness of the MoEHE employees and passers-by on the issue and the potential of this source of energy.

Indicate factors which led to project's success:

- Presence of design companies able to integrate green building concepts into their design thanks to the input of international consultancy;
- Availability of construction companies able to integrate appropriate technologies;
- Availability of companies able to install and maintain PV panel systems;
- MoEHE was keen to integrate innovative technologies into the design of the Palestinian schools and to maintain them.

Technology transferred:

- Green building concepts (orientation, sun protection, insulation…)
- Geothermal ducts, solar chimneys, solar walls,
- Photovoltaic panel systems connected to the grid

Impact on greenhouse gas emissions/sinks (optional)

- Thermic users' comfort was improved without energy production
- Energy produced without using fossile energy

4. Project/programme title: African Climate Change Fund

Purpose:

The ACCF specifically aims to:

- Assist African countries to access larger amounts of climate finance and use provided funds more effectively;
- Help African countries to account for climate change in their growth strategies and policies, by means of upstream diagnostics and providing technical assistance;
- Facilitate African countries' development of investment plans and climate-resilient and low-carbon projects;
- Co-finance climate-resilient and low-carbon projects;
- Collect, consolidate, analyse and disseminate information and learnings related to climate-resilient and low-carbon development;
- Provide capacity-building in climate change and green growth for African countries and stakeholders at national and regional levels;
- Help African countries to prepare for conferences of parties to the United Nations Framework Convention on Climate Change.

Recipient Country
Africa
Sector
multisector
Total Funding
2 million EUR
Years in operation
2018-2019

Description:

The African Climate Change Fund (ACCF) was created by the African Development Bank in April 2014 with an initial contribution of 4 725 million EUR from the government of Germany to support African countries developing resilience to the negative impacts of climate change and in transitioning to sustainable low-carbon growth.

The ACCF secured an additional funding commitment of 4.7 million EUR from the government of Italy at the end of 2015 and a commitment of 2 million EUR from the government of Flanders, Belgium in 2016, bringing the total contributions to the ACCF since its inception to over 11.4 million EUR. These commitments have allowed the ACCF to scale-up to a multi-donor trust fund. On March 15, 2017, the Board of Directors of the African Development Bank (AfDB) approved the conversion of the Africa Climate Change Fund (ACCF) to a multi-donor trust fund.

Indicate factors which led to project's success:

- A clear need to scale up access to international climate finance for African countries, which are heavily underrepresented as recipient
- Clear goal of the AfDB to triple its annual climate financing to reach $5 billion a year by 2020 $5 billion a year by 2020 (the Bank's Climate Change Action Plan + 2013-2022 strategy)
- Country ownership: projects are designed to respond to demonstrated needs of African countries and are executed by national government or non-government actors
- Leverage effect: investing in technical assistance helps African countries to attract climate finance
- Clear monitoring and evaluation framework of the fund, cooperation with the Environment & Climate Finance division within the African Development Bank
- The African Development Bank is an accredited implementing partner of the Green Climate Fund.
- The ACCF is a member of the Readiness Coordination Mechanism of Green Climate Fund and coordinates closely with the GCF Secretariat and other partners to ensure coordination and complementarity of supported activities
- The new multi-donor structure allows for other donors to step in

Technology transferred:

- preparation for accessing climate funding; integration of climate change and green growth into strategic documents and/or projects; preparation and funding of adaptation and mitigation projects; piloting of innovative adaptation approaches and technologies; climate change-related knowledge management and information sharing; capacity building; preparation of climate change-resilient and low-carbon strategies and policies; green growth analysis work; advocacy and awareness-raising.

5. Project/programme title: Flemish Water for Development Partnership/ Vlaams Partnerschap Water voor Ontwikkeling (VPWvO)

Purpose:

The Flemish Water for Development Partnership aims to contribute to SDG 6 (before: MDG 7c) by implementing sustainable water and sanitation projects in the global South, also fostering the transfer of expertise and technology.

Involving over 90 partners, ranging from NGOs, public water companies, private firms over local authorities and regional administrations to academic and research institutions active in the water sector, the Flemish Water for Development Partnership creates leverages and synergies between local actors in the South and actors in Flanders.

Recipient Country
Global
Sector
Water and sanitation
Years in operation
Since 2004

Description:

For a Flemish Partnership project to be approved for co-financing by the government of Flanders, at least two Flemish partners and at least one local partner must cooperate and contribute to the project. Flemish actors can either

contribute financially, or in the form of technical expertise, or in a combination of both. These partnerships create synergies and a healthy exchange of knowledge and expertise, for the benefit of all involved (North and South). Appropriate tools and technology are chosen, taking into account the capacity of the beneficiaries. Examples can be given in the field of sanitary infrastructure, drinking water installations, solar energy, drinking water quality, water source protection, etc. Every project also includes a capacity building component to guide and coach the stakeholders to use the tools and technology, to maintain the installations and to transfer the infrastructure and good practices to the stakeholders.

To date, these projects benefited over one million southern citizens in terms of access to water, and over 800 000 in terms of meeting their sanitation needs.

This Partnership is one of the channels for providing international climate finance by the Government of Flanders, but its main focus is on water and sanitation. Only climate-related support is reflected in the field "total funding".

Indicate factors which led to project's success:

- A broad range of partners are involved
- Local ownership
- Leverage effect in terms of finance and capacity building
- N-N, N-S and S-S Co-operation and exchange of expertise

Technology transferred:

- Mainly related to drinking water and sanitation infrastructure, tools on integrated water management, solar energy installations.

Annex 5. Acronyms

AAU	Assigned Amount Unit
AEA	Annual Emission Allowances
AED	Administration for Equipment and Travel of the Brussels Capital Region
ALARO	Atmospheric numerical model are used for making weather forecasts
AMICE	Adaptation of the Meuse to the Impacts of Climate Evolutions
ANAEE	Infrastructure for Analysis and Experimentation on Ecosystems
APERe	Association for the promotion of renewable energy
AR5	5th Assessment Report of IPCC
AWAC	Walloon Agency for Air and Climate
BatEx	Exemplary Buildings Project
BBRI	Belgian Building Research Institute
BCR	Brussels Capital region
BELLS	Belgian Lightning Location System
BELSPO	BELgian Science POlicy
BERA	Belgian Energy Research Alliance
BIO	Belgian Investment Company for Developing Countries
BISA	Belgian Institute for Space Aeronomy
BLAST	Bringing Land and Sea Together
BRAIN-2	Belgian Research Action through Interdisciplanary Network -2
BRAIN-BE	Belgian Research Action through Interdisciplanary Network
BRISTI	Belgian report on science, technology and innovation 2010
BRUGEL	Society distributing gaz and electricity in the Brussels-Capital region
BYE	Base-year level
CAP	Common Agricultural Policy
CC	Climate Change
CCGT	Combined-cycle gas power plant
CCIEP	Coordination Committee for International Environmental Policy
CDM	Clean Development Mechanism
CELINE	Belgian Interregional Cell for the Environment
CER	Certified Emission Reduction

CFC	chlorofluorocarbon
CGIAR	Consultative Group on International Agricultural Research
CH_4	Methane
CHP	combined heat and power
CIAT	International Center for tropical Agriculture
CIUF	Interuniversity Council of the French Community
CMIP5	Coupled Model Intercomparison Project Phase 5
CNG	Compressed Natural Gaz
CO	Carbon monoxide
CO_2	Carbon dioxide
COBRACE	Brussels Air, Climate and Energy control Code
CONCERE	Concertation between the federal state and the regions about energy
COP	Conference Of the Parties
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
COST	European Cooperation in Science and Technology
CP1	1st commitment period under the Kyoto Protocol
CP2	2nd commitment period under the Kyoto Protocol
CPAS	Public center of social welfare
CRF	Common reporting format
CRIE	Regional center for ecology initiation
CSA	Coordinatian and support action
DD	Degree-days
DG	Directorate-general
DGARNE	Directorate-general of the Agriculture, Natural Resources and Environment
DGD	Directorate General Development Cooperation and Humanitarian Aid
DGSIE	Statistics Belgium
DNA	Designated National Authority
DRC	Democratic Republic of the Congo
DUWOBO	Transition Arena for Sustainable Living and Building
EC	European Commission
ECONOTEC	Energy and environmental consultants
EE	Environmental Education
EEA	European Economic Area
EEA	European Environment Agency

EEDI	Energy Efficiency Design Index
EERA	European Energy Research Alliance
EESD	Education for Environment and Sustainable Development
EPB	Energy performance of buildings
EPM	Energy/Emissions Projection Model
ERA-NET	European Research Area Network
ERANet-LAC	Network of the European Union, Latin America and the Caribbean Countries on Joint Innovation and Research Activities
ErE	Environmental education
ErE DD	Education for Environment and Sustainable Development assignments
ERU	Emission Reduction Unit
ESA	European Space Agency
ESD	Effort Sharing Decision
ESFRI	European Strategic Forum on Research Infrastructures
ESNII	European Sustainable Nuclear Industrial Initiative
ETS	Emission Trading Scheme
EU	European Union
EUA	European Union Allowances
EWI	Economy, Science and Innovation Department
FAO	Food and Agriculture Organization (of the United Nations)
FCC	Federal Cooperation Commission
FCH	Fuel Cell and Hydrogen
FEBIAC	Belgian federation of the Cycle and Motor-car industry
FED	Federal Government
FEDESCO	Federal Energy Services Company
FED-tWIN	Programme of sustainable research cooperation between the federal scientific institutes (FSI) and the universities
FP	Focal Point
FPB	Federal Planning Bureau
FPS	Federal public service
FRIS	Flanders Research Information Space
FRS-FNRS	(National) Fund for Scientific Research
FWO	Fund for Scientific Research Flanders
GBAORD	government budget appropriations or outlays for R&D
GCF	Green Climate Fund

GCOS	Global climate observation system
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GWP	Global Warming Potential
HF	Hydrogen fluoride
HFC	hydrofluorocarbon
HICP	harmonised indices of consumer prices
IBGE-BIM	Brussels Environment
ICAO	International Civil Aviation Organization
ICARDA	International Center for Agricultural Research in the Dry Areas
ICC	International Cooperation Commission
ICE	Interministerial Conference for the Environment
ICOS	Integrated Carbon Observatory System
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IEA	International Energy Agency
IFAD	International Fund for Agricultural Development
IITA	International Institute of Tropical Agriculture
ILVO	Institute for Agricultural and Fisheries Research
IMCSP	Interministerial Conference on Science Policy
IMO	International Maritime Organization
INBO	Research Institute for Nature and Forest
INNOVIRIS	Brussels Institute for Research and Innovation.
IPCC	Intergovernmental Panel on Climate Change
IPF	International Polar Foundation
IRCEL	Belgian Interregional Cell for the Environment
ISABU	Institute of Agricultural Sciences of Burundi
ITL	International transaction log
JI	Joint Implementation
JP	Joint Program
JPI	Joint programming initiative
JPI-CLIK-EU	Joint Programming Initiative Connecting Climate Change Knowledge for Europe

KLIMOS	Research Platform Climate Change and Development Cooperation
KOMOSIE	dome of environmental entrepreneurs in the social economy
KP	Kyoto Protocol
KULeuven	Catholic university of Leuven
kWh	kiloWatthour
LDCs	Least Developed Countries
LDCF	Least Developed Countries Fund
LLDCs	Landlocked Developing Countries
LNE	Environment, Nature and energy
LPG	liquefied petroleum gas
LSUE	Leuven Sustainable Earth Research Centre
LUCF	Land Use Change and Forestry
LULUCF	Land Use, Land-Use Change end Forestry
MACCBET	Modelling atmospheric composition and climate for the Belgian territory
MASC	Modelling and Assessing Surface Change impacts on Belgian and Western European climate
MDG	Millennium Development Goals
MIRA	Environmental report Flanders
MODIRISK	Mosquito vectors of disease: spatial biodiversity, drivers of change, and risk
MOP	Meeting Of the Parties
MOS	Environmental protection at school
MRG	Monitoring and Reporting Guidelines
MRV	Monitoring, Reporting, Verification
N_2O	Nitrous oxide
NAMA	Nationally Appropriate Mitigation Action
NATO	North Atlantic Treaty Organization
NCC	National Climate Commission
NCEP	National climate and energy plan
NCP	National climate plan
NGO	Non-governmental organization
NIR	National inventory report
NIS	National Inventory System
NMBS	National Railway Company of Belgium
NOx	Nitrogen Oxides

O&M	Operating and maintenance
ODA	Official Development Assistance
ODE	Organization for sustainable energy
OECD	Organisation for Economic Cooperation and Development
OECD-DAC	Development Assistance Committee of the Organization for Economic Cooperation and Development
OVAM	Flemish Public Waste Agency
PAMAXEA	PAtterns and Mechanisms of climate Extremes in East Africa
PAMs	Policies and measures
PFC	Perfluorocarbon
PLAGE	Local Programme of Action for Energy Management
PLUIES	Prevention and Fight against Floods and their effects on victims
PLURISK	Forecasting and management of extreme rainfall induced risks in the urban environment
PM	Particule matter
PMP	Passive house platform
PMV	Flemish Participation Company
ppm	parts per million
PPS	Federal Public Planning Service
PRDD	Regional Sustainable Development Plan
PRI	Regional Innovation Plan
PV	Photovoltaic
QA/QC	Quality Assurance / Quality Control
R&D	Research & Development
RBINS	Royal Belgian Institute of Natural Sciences
RCEP	Regional Circular Economy Program
RCPs	Representative Concentration Pathways
RD	Royal decree
RER	Suburban network
RIB	Research in Brussels
RIO	Research and Innovation Observatory
RMCA	Royal Museum for Central Africa
RMI	Royal Meteorological Institute
RMU	Removal unit
ROB	Royal Observatory of Belgium

RUE	rational utilization of energy
SAFECOAST	Sustainable Coastal Risk Management in 2050
SDG	Sustainable Devlopment Goals
SEEMP	Ship Energy Efficiency Management Plan
SF6	sulphur hexafluoride
SIC-Adapt	Strategic Initiative Cluster - Adaptation to Spatial Impacts of Climate Change
SIDS	Small Island Developing States
SINCERE	Widening international cooperation activities on climate adaptation and mitigation
SME	Small and medium-sized enterprises
SNCB	National Railway Company of Belgium
SSD	Science for a Sustainable Development
STEREO	Earth observation by satellite research programme
STI	Science, Technology and Innovation
STIB	Brussels transport society
SUDEMCLL	Impact of Climate Change on River Hydrology and Ecology: A Case Study for Interdisciplinary Policy Oriented Research
TCCON	Total Carbon Column Observing Network
tCER	Temporary certified emission reduction
TECLIM	Georges Lemaître Centre for Earth and Climate Research
TIDE	Tidal River Development
Toe	Ton of oil equivalent
TT	Technology transfert
UCL	Catholic university of Louvain-la-Neuve
UHI	urban heat island
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations' Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UREBA	Rational Use of Energy in Buildings
US	United States
UV	Ultraviolet
UWE	Walloon union of companies

VAP	Flemish Adaptation Plan
VAT	Value added tax
VEA	Flemish Energy Agency
VILT	Flemish information center for agriculture and horticulture
VITO	Flemish Institute for Technological Research
VLAIO	Agency Flanders Innovation & Entrepreneurship
VLAKWA	Flanders Knowledge Center Water
VLIR	Flemish Interuniversity Council
VLIZ	Flanders Marine Institute
VMM	Flemish Environment agency
VMP	Flemish Mitigation plan
VOC	Volatile Organic compound
VOCs	Volatile Organic compounds
VPWvO	Flemish Partnership Water for Development
VSV	Flemish foundation for road safety
VUB	Free University Brussels
WAM	With additional measures
WARDA	West Africa Rice Development Association
WB	Wallonia-Brussels
WBI	Wallonia-Brussels International
WEM	With Existing Measures
WG	Working group
WMO	World Meteorological Organisation
WWF	World Wide Fund for Nature

NATIONAL CLIMATE COMMISSION

federal public service
HEALTH, FOOD CHAIN SAFETY AND ENVIRONMENT

brussels environment
.brussels

Air Climat
agence wallonne de l'air & du climat

Flanders
State of the Art

Belgian Science Policy Office
belspo

economie
FPS Economy, S.M.E.s, Self-employed and Energy

Federal Public Service
Mobility and Transport

THE BELGIAN DEVELOPMENT COOPERATION .be

Federal Planning Bureau
Economic analyses and forecasts

FÉDÉRATION
WALLONIE-BRUXELLES

irCELine

RMI