ECONOTEC
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Energy Efficiency Policies and Measures in Belgium

ODYSSEE- MURE 2010

Monitoring of EU and national energy efficiency targets

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Contacts:

Francis Altdorfer
Yvonne Baillot
ECONOTEC
Rue Charles Martel 50, B-1000 Brussels
Tel.: +32 2 231 10 17
E-Mail: francis.altdorfer@econotec.be
www.econotec.be

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Contents

Page

Index of figures

Index of tables

Warning

For the energy consumptions, the ODYSSEE data base uses federal statistics, except for the final energy consumption of the industrial sector, where the sum of the energy consumptions of the three Regions has been used, because they appear to be more reliable (among other things because the regional energy balances better take into account the consumption of waste products, in cement ovens etc.).

General remarks on the quality of the available data used in this report are given in Annex 3.

1 Executive Summary

This report is the country report for Belgium on Phase 12 of the “ODYSSEE-MURE” project, extending from May 2010 to November 2012.

It provides an overview of energy efficiency trends (for the period 2000-2010), based on indicators calculated using the ODYSSEE data base, developed and updated in the framework of the project, as well as of the main energy efficiency policy measures.

The final energy consumption of the country is analysed both as a whole and by major final consumer sector: industry, residential, tertiary, transport. For each sector, it has been aimed to assess the size of energy efficiency changes, to identify main factors responsible for these changes and to assess the contributions of these factors.

While GDP stagnated in 2008, dropped in 2009 and just reached its value of 2008 again in 2010, as a result of the economic crisis, the overall energy consumption has more or less stabilised. However, the situation differs across sectors: since 2007, the energy consumption rose in the residential, tertiary and transport sectors, while it declined in industry. by 1,0% and the final energy consumption by 4,9%.

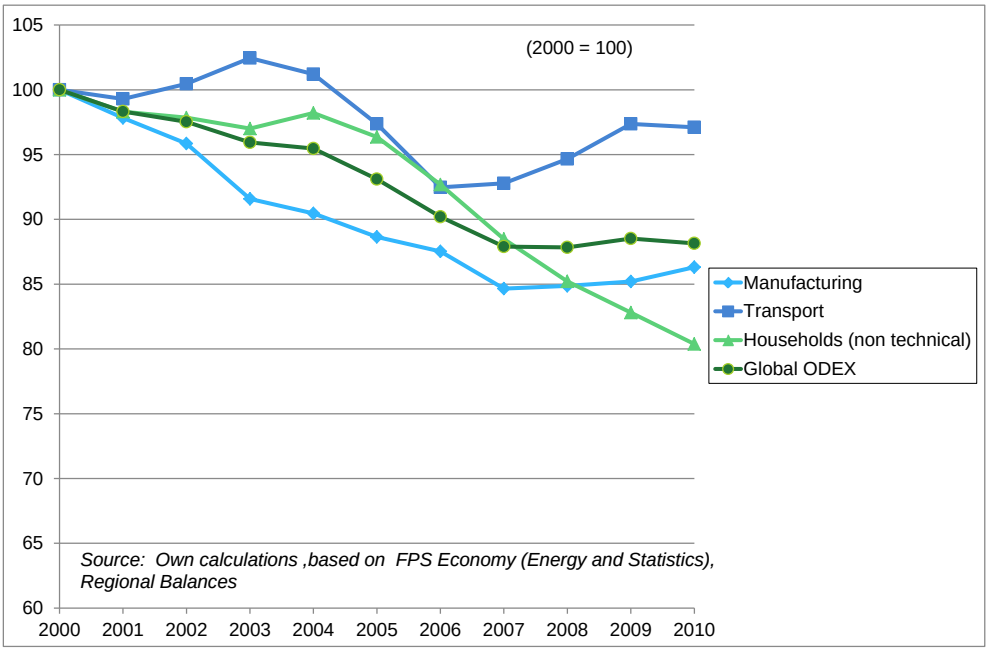
While the primary and the final energy intensities have been regularly decreasing up to 2007, since then they have become rather stable.

While energy intensities show an energy efficiency in economic terms (measuring the quantity of energy used to produce one euro of GDP or value added), the ODEX indicator, developed in the framework of the ODYSSEE project, aims to best reflect the evolution of the technical efficiency of energy use of a sector, at any aggregation level. It is a kind of weighted average of unit energy consumptions of elementary components of the sector, based as far as possible on activity variables expressed in physical units.

The evolution of the ODEX indicator by sector is shown on Figure 1.

After a strong decline (denoting an increase in efficiency) up to 2007, the overall ODEX indicator has also become roughly stable since then, with contrasting situations across sectors: a fall in residential, a rise in transport and more or less a stabilisation in industry and the tertiary sector.

Figure 1: ODEX indicator by sector



Energy efficiency policy is mainly a responsibility of the three Regions, and to a lesser extent of the federal government. The main policies and measures have been introduced in the MURE database, with their major characteristics. Among the latter, quantitative impact evaluations are available for a large number of measures, which are synthesised in Table 1 (in terms of final energy savings).

Table 1: Summary of quantitative impact evaluations

Sector	2010 (PJ)	2016 (PJ)
Household	12,2	33,4
Tertiary	4,2	11,7
Industry	7,4	9,2
Transport	4,0	22,1
General cross-cutting	24,0	48,5
Total	51,8	125,0

2 Key messages

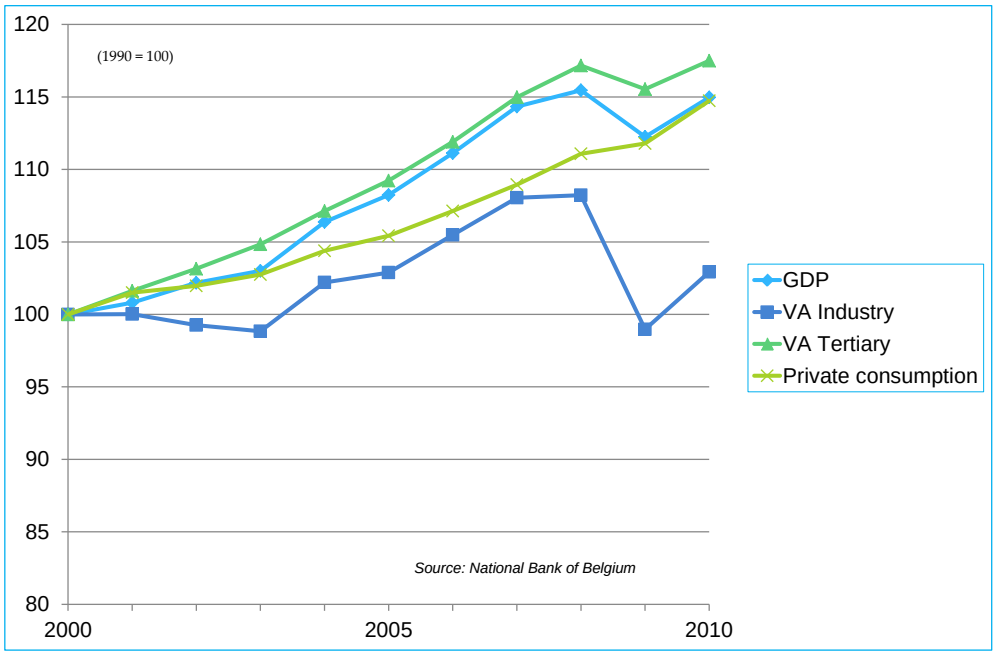
- The economic crisis has hit the country especially in 2009, where GDP fell by 2,8% and value added of industry by 8,5%. A rebound occurred in 2010, where GDP regained its value of 2008.
- The economic crisis has been accompanied by a halt in the overall progress of energy efficiency. This is reflected as well in the evolution of the energy intensity as in that of the ODEX.
- The situation differs across sectors: while energy efficiency progress was stopped in industry, presumably due to low capacity use and delayed investment, it has continued in the residential sector, as the sectoral ODEX indicators show.
- The quality of the indicators is still limited, because of a lack of reliable disaggregated statistical data on certain energy consumptions and activity variables.
- The requirements for monitoring energy efficiency and impacts of policy measures are expected to increase in the future, in the framework of the new energy efficiency directive (in particular, art. 24 of EU directive 2012/27 requires Member States to report on progress achieved towards national energy efficiency targets).

3 The Background to Energy Efficiency

3.1 Overall economic context

The evolution in real terms of the main macro-economic indicators since 2000 is shown on Figure 2: GDP, value added of industry, value added of the tertiary sector and private consumption of households. The impact of the economic crisis of the last few years can clearly be seen, with a dip in 2009 of 2,8% in GDP, 1,4% in the tertiary sector and 8,5% in industry, and a rebound in 2010. However, the private consumption of households has not diminished, only its growth rate was reduced in 2009.

Figure 2: Evolution of GDP



Overall over the period, industry is the sector with the slowest growth.

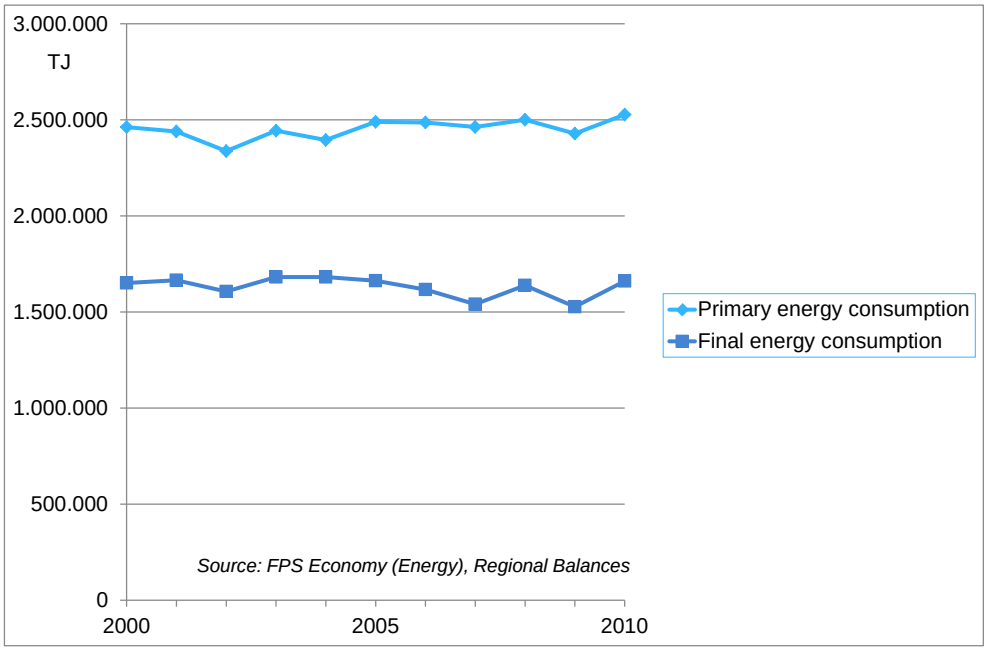
3.2 Energy consumption trends

The evolution of the final energy consumption (before climate correction) over the last three years, shown on Figure 3, can mainly be explained by the number of degree-days (see Figure 10) and the economic crisis (Figure 2). The dip in 2009 is due to the

crisis, the rebound in 2010 to the economic recovery and the high number of degree-days that year (highest value since 1996, see Figure 10).

The total primary energy consumption has practically stabilised since about the year 2000, with a low in 2002 (the warmest year after 2007). The dip in 2009 and the re-bound in 2010 follow those of the final energy consumption, but more smoothly.

Figure 3: Evolution of total energy consumption



Together, both evolutions show a decrease in the ratio final/primary energy consumption, which could partly be explained by an increase in the share of electricity in final energy consumption, which increased from 18% in 2000 to 19% in 2010 (Figure 4 and Figure 5).

Figure 4: Total final energy consumption by energy carrier - 2000

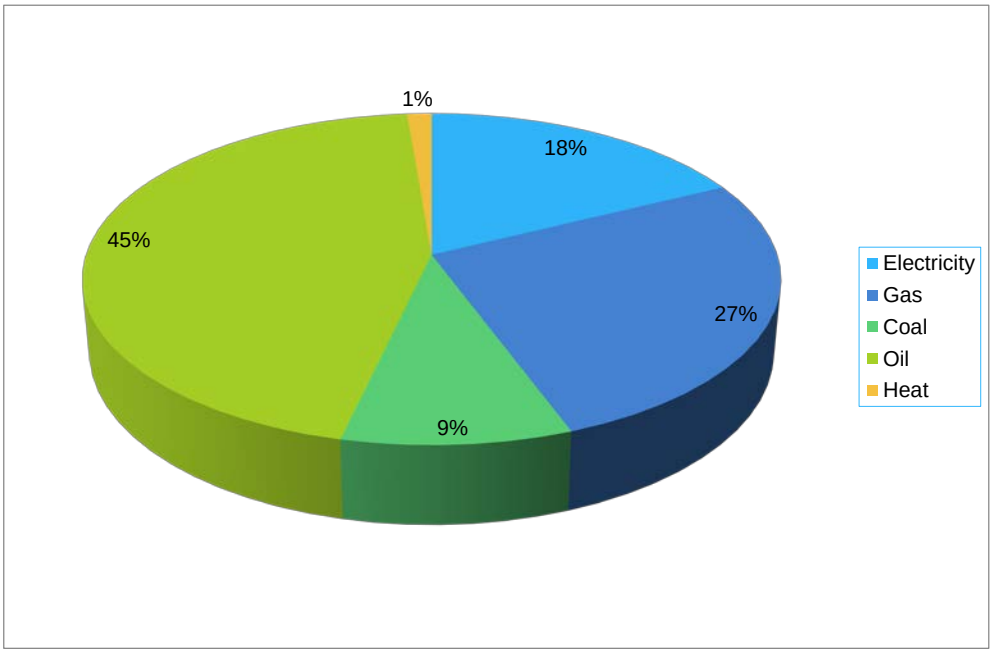


Figure 5: Total final energy consumption by energy carrier - 2010

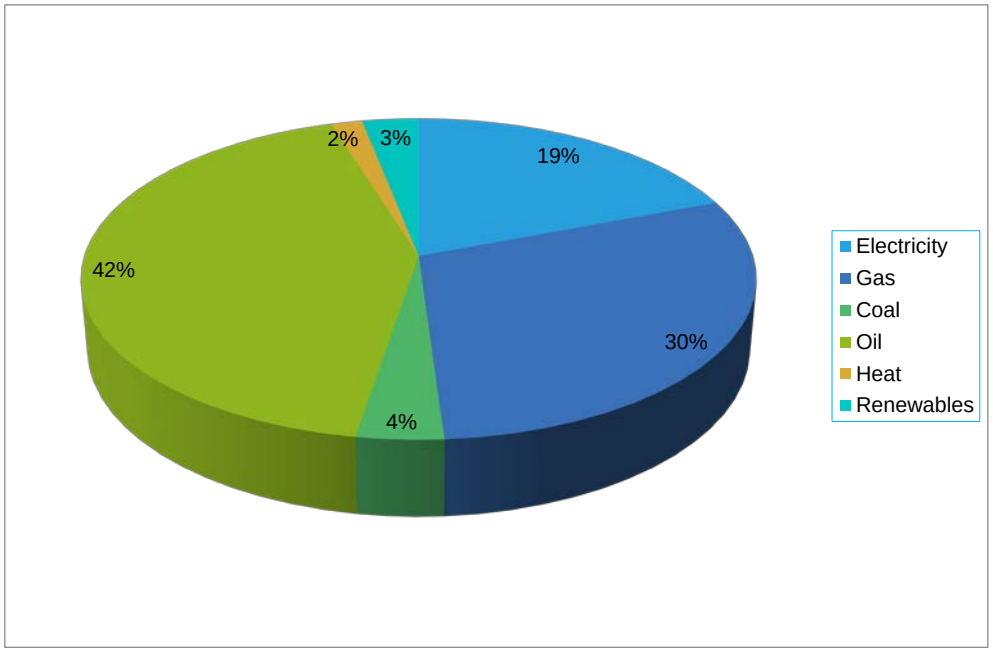


Figure 6 shows the development of the final energy consumption by major sector over the period 2000-2010 (without climate correction).

The main energy consumer is industry, but its share is diminishing. It is followed by the transport and the residential sectors. The tertiary sector has only about half the consumption of the residential one.

Striking is the dip in industrial consumption in 2009, due to the crisis.

Figure 6: Final energy consumption by sector (ktoe) (before climate correction)

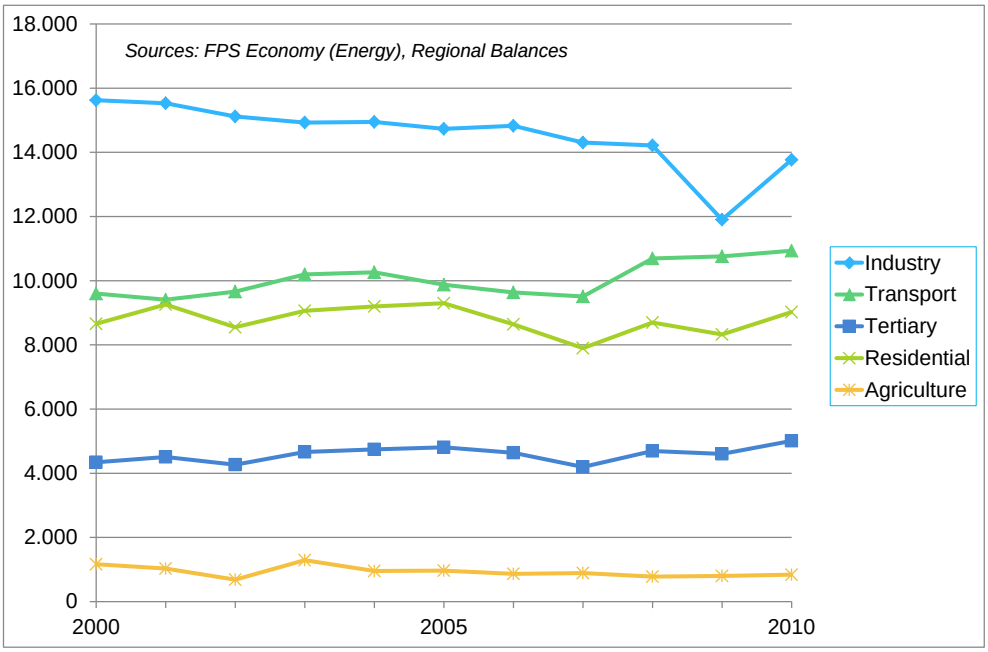
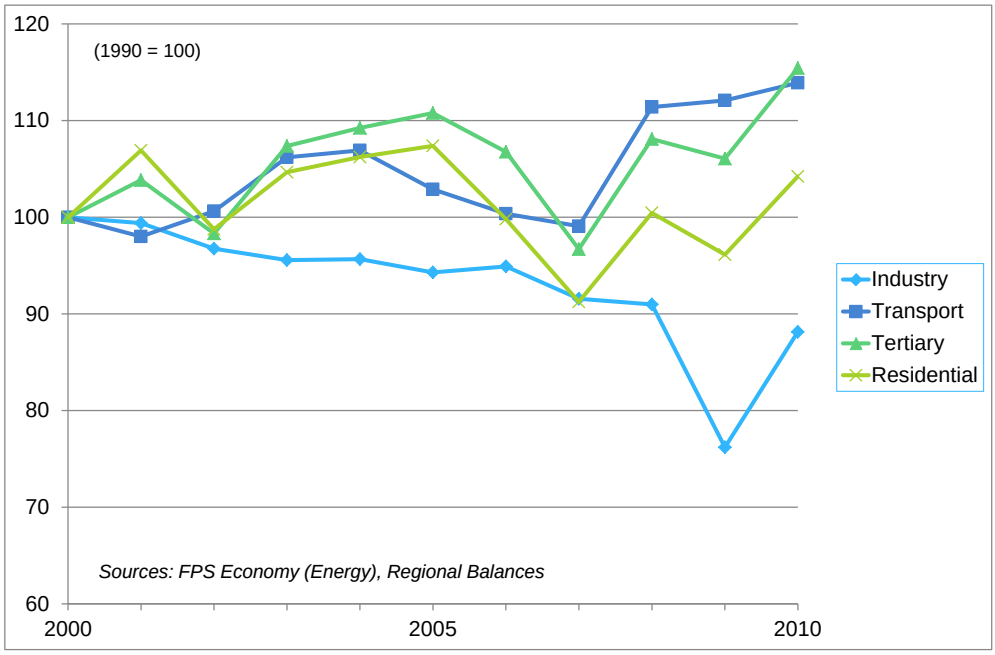


Figure 7 shows the evolution since 2000 more clearly.

Figure 7: Evolution of final energy consumption by sector



Before climate correction

The largest growth over the period is that of the tertiary and transport sectors[1]. Industry has been steadily decreasing, while the residential sector has been fluctuating around its value in 2000.

3.3 The policy background to energy efficiency

3.3.1 Policy making process

In the Belgian federal system, policies and measures to improve energy efficiency and to reduce greenhouse gas emissions are established at different levels of government, according to the division of power between the federal state and the regions. Each of these levels of power establishes its own priorities for energy efficiency and climate policies. However, the regions have the bulk of the competencies for these two fields.

[1] It should be noted that for the transport sector international bunkers are included.

A coordination of the federal and regional policies is taking place in the framework of the CONCERE/ENOVER committee as far as energy efficiency is concerned, and of the National Climate Commission (NCC) as far as greenhouse gas emissions are concerned. The general context for the preparation of policies and measures regarding climate change is established by a number of guiding plans drawn up by the federal and regional authorities, which determine policy objectives and strategies.

3.3.2 National climate policy

Climate change is one of the main driving forces for the energy efficiency policy. In January 2009, the National Climate Commission has issued the “National Climate Plan 2009-2012”. This document provides a detailed inventory of the existing federal and regional policies and measures taken up to 31 December 2008, which are either classified by sector or as cross-cutting ones.

The 'Cooperation Agreement [between the federal government and the three Regions] for the implementation of a National Climate Plan and reporting in the context of the UNFCCC and the Kyoto protocol', adopted on 14 November 2002, concerns the implementation and the follow-up of the National Climate Plan and the establishment of reports in the context of the UNFCCC, the Kyoto Protocol and the decision for a Monitoring Mechanism (Decision 280/2004/EC), with the ultimate goal of reducing emissions of CO2 and other greenhouse gases.

To implement this Cooperation Agreement, the National Climate Commission (the executive body of the Cooperation Agreement) was formally put into place on 5 December 2003. This Commission is an essential instrument for the implementation of the Kyoto Protocol in Belgium. It has a key role in assessing and monitoring the national climate policy and the institutional setting-up of the flexible mechanisms. The NCC is composed of representatives of the federal and regional governments.

Within the framework of the Cooperation Agreement, an internal burden sharing arrangement was agreed on 8 March 2004 between the federal government and the three regions. This agreement defines differentiated targets for the three regions, and determines the extent to which the federal government will contribute to the national effort, through both the implementation of domestic measures and the acquisition of emission allowances on the international market.

Each of the three Regions has developed its own climate plan. The Flemish Climate Policy Plan 2006-2012 (FCP) was approved by the Flemish government on 20 July 2006. The Walloon Air-Climate Plan was adopted by the Walloon government in March 2007. The Brussels-Capital Region adopted on 13 November 2002 (Decision G-

31.55.0) an eight-year Air and Climate Plan, the Plan for Structural Improvement in Air Quality and the Fight against Climate Change, 2002-2010.

Currently (November 2012), a new climate plan is being prepared in each of the three regions, which will subsequently lead to the development of a new national climate plan.

3.3.3 Energy efficiency policies

Energy efficiency is mainly a responsibility of the Regions. The federal government is responsible for specific aspects such as the fiscal policy, the pricing policy and product policies.

The energy efficiency policies are set out in the Second National Energy Efficiency Action Plan (NEEAP) in the framework of EU directive 2006/32 on energy end-use efficiency and energy services (NEEAPs translated in English). This plan compiles and comprises as annexes the individual plans of the federal government and of each of the three Regions (Flanders, Wallonia and Brussels-Capital).

The NEEAP specifies energy saving objectives to be reached by the Regions, with the help of the federal policy measures. It describes and provides impact evaluations for the energy efficiency policy measures taken by the relevant federal and regional authorities.

3.3.4 Renewable energy policies

According to the special law on institutional reforms of 8 August 1980, renewable energies are the competence of the regions, except for large storage, transport and energy production infrastructures, tariffs and fiscal policy.

The renewable energy policies are described in the Renewable Energy Action Plan, established in November 2010 in the framework of Directive 2009/28/EC.

For the production of renewable energy, Belgium has set up a system of green certificates and of guaranteed minimum prices for supporting the development of electricity production from renewable energy. The production of renewable energy is also supported by the regions through investment aids and grants for households and by the federal level by a series of measures aiming at developing offshore wind energy on the Belgian continental plateau of the North Sea and by fiscal deductions for companies and fiscal reductions for households. All these actions are supported by important information, training and awareness raising actions, aimed at companies, at the general public and at various actors of the sector.

4 Overall Assessment of Energy Efficiency Trends

The energy efficiency trends are analysed both in terms of energy intensities and in terms of the ODEX indicator. Both approaches are complementary; they differ as to their meaning and the quality of the data.

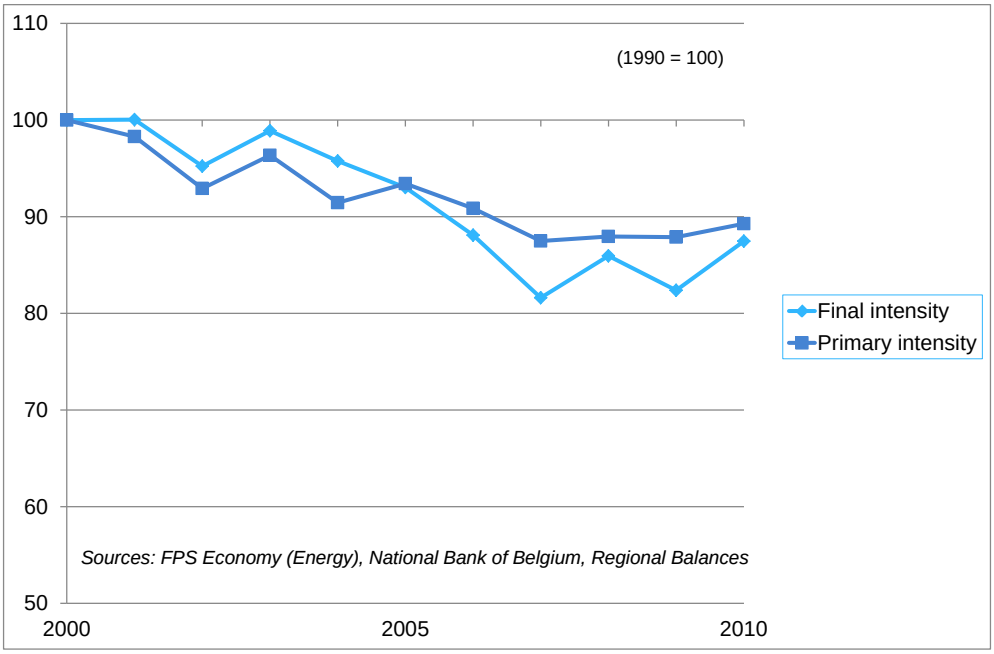
4.1 Overall trends in energy intensity

4.1.1 Energy intensity of GDP

The energy intensity is obtained by dividing the energy consumption of a sector by its value added or, in case of the transport sector, by the GDP. It is an indicator of "economic" energy efficiency, in that it shows how much energy is being used to produce one unit of economic output.

Figure 8 shows the evolution of the energy intensity of both primary and final energy consumptions[2].

Figure 8: Evolution of the energy intensity (without climate correction)



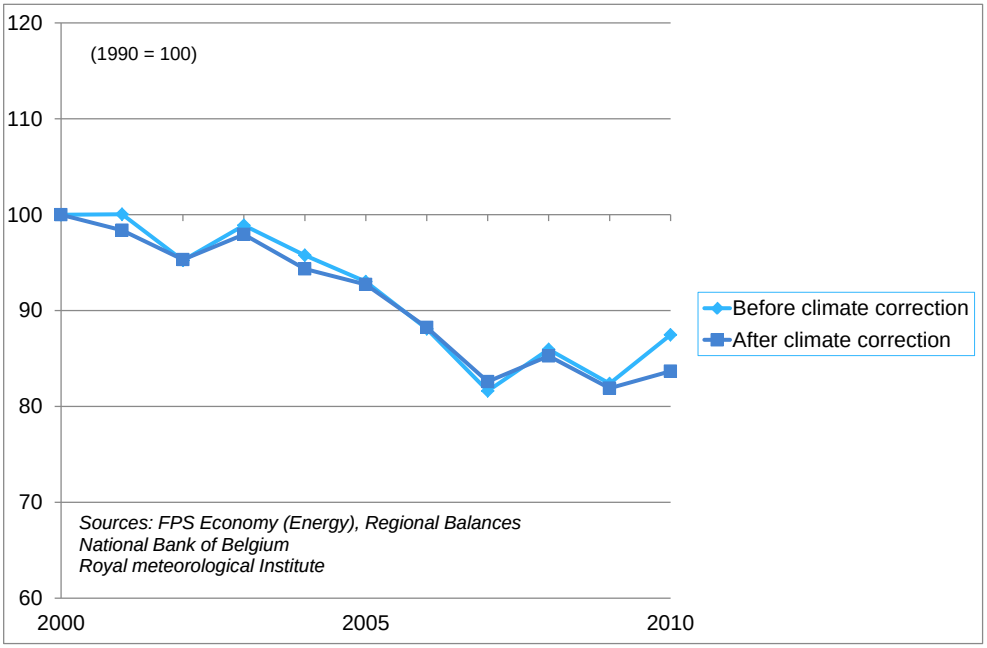
2 Before climatic correction and without the energy consumption for non energy uses.

The general decreasing trend confirms the decoupling of energy consumption from the economic activity, except for the last three years, which were affected by the economic crisis.

The evolution in time should rather be appreciated after climate correction (i.e. at constant climate), which is shown on Figure 9 for the final energy consumption.

After climate correction (see the evolution of the number of degree-days on Figure 10), the curve becomes a little smoother, and the energy intensity of total final energy is generally decreasing, except for the year 2003, 2008 and 2010.

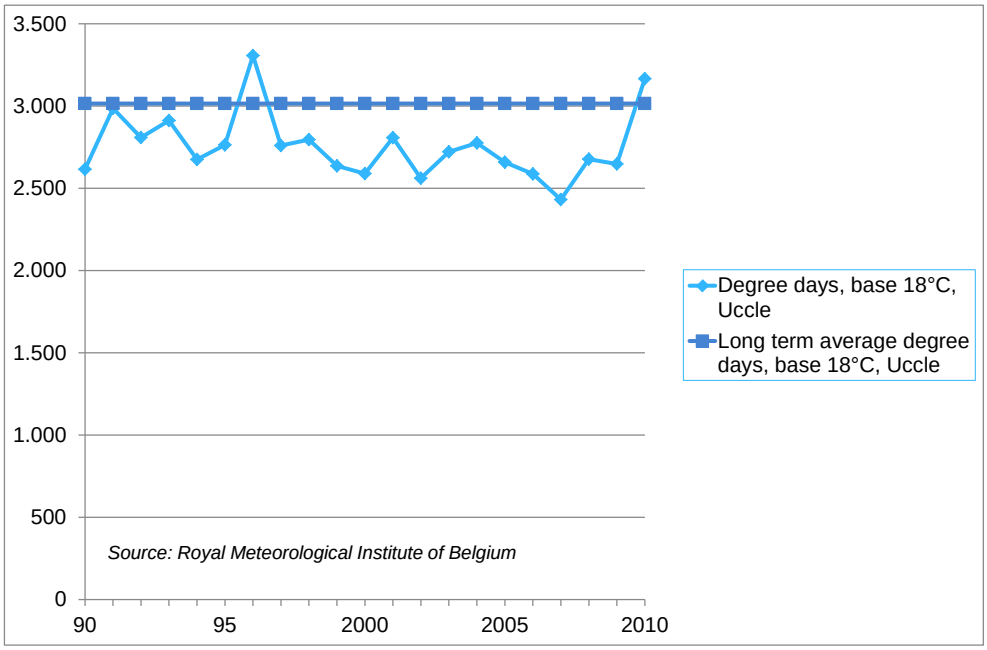
Figure 9: Evolution of energy intensity of total final energy



The anomaly observed for 2002-2003 relates to the residential sector. It should be noted that– based on the number of degree-days taken into consideration – 2002 is the hottest year of the period, after 2007.

Figure 10 shows the evolution of the number of degree-days in Uccle (Brussels) since 1990, as well as the long term average, which have been used for calculating the climate correction.

Figure 10: Number of degree-days (18/18 Uccle)



2007 is the hottest year of the whole period (actually even since 1970). It can be noticed that since 1990, 1996 and 2010 are the only years with a colder than “normal” (long term average) climate as defined by the Royal Meteorological Institute, which shows that the average climate is clearly becoming hotter.

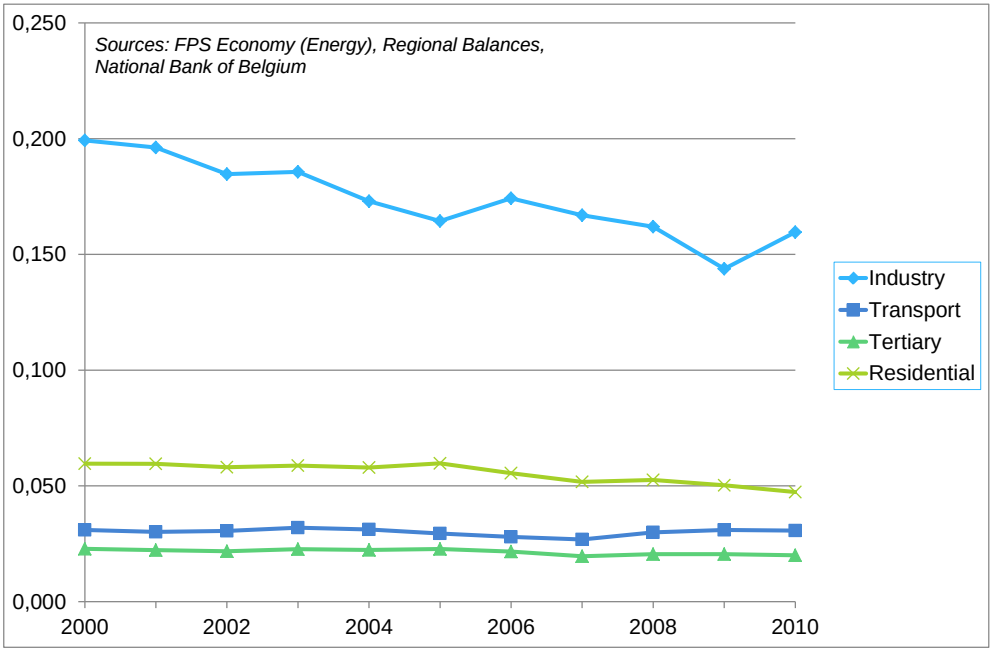
4.1.2 Energy intensity by sector

Energy intensities (after climate correction) by major end-use sector are presented on Figure 11. They were obtained by dividing the energy consumption by the following, closely related, activity variables:

- value added, in the case of the industrial and tertiary sectors;
- private consumption of households, in the case of the residential sector;
- GDP, in the case of the transport sector.

Figure 11 shows that, as they are defined, the energy intensity of industry is 6 to 7 times higher than those of the tertiary and the transport sectors.

Figure 11: Final energy intensity by sector (ktoe/M€) (after climate correction)

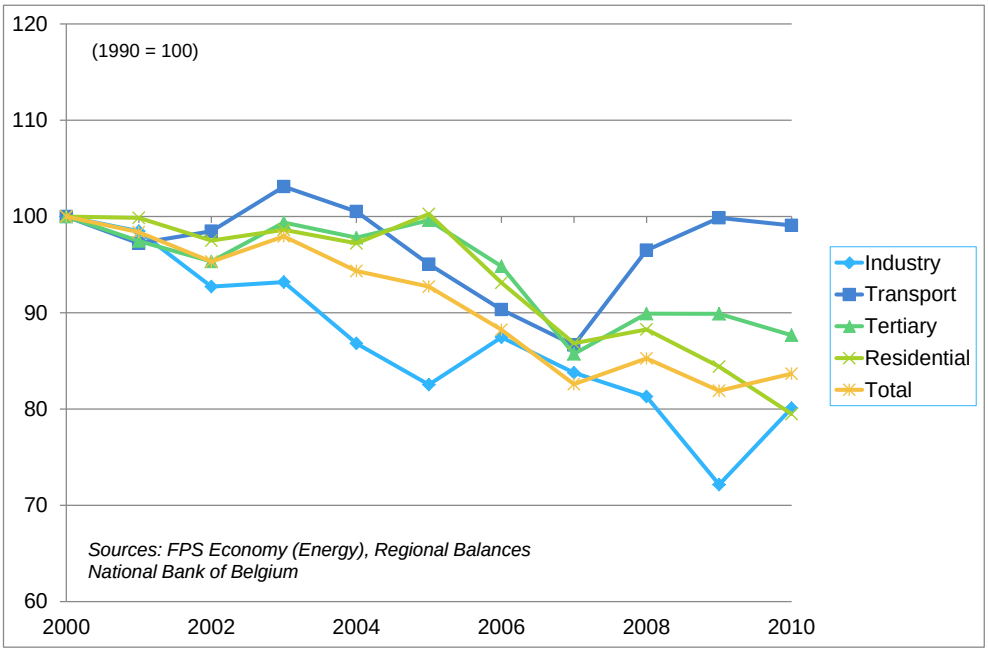


It should be stressed that these energy intensities remain imperfect measures, especially because the activity variables used are only imperfect indicators of the real activity changes.

Besides, these indicators are influenced not only by energy efficiency, but also by structural effects taking place within each sector (typically, a switch towards activities with a lower energy consumption per unit of value added).

Figure 12 shows that the general trend is decreasing, the largest decrease taking place in industry and the residential sector. It should be noted that for transport, the large rise after 2007 is only due to a revision of the methodology for transport statistics. Noteworthy is that in 2009 the impact of the crisis has been a significantly lower intensity in industry, due to the fact that the most energy intensive industries were the most impacted by the crisis.

Figure 12: Evolution of final energy intensity by sector (after climate correction)



It is interesting to notice that the overall energy intensity has decreased more than the average of the sectors. This reveals a structural effect corresponding to a shift away from industry (which has a higher intensity) towards less energy intensive sectors.

This can indeed be seen by examining together:

- the evolution of the activity variables on Figure 2;
- the relative levels of energy intensity of the various sectors on Figure 11.

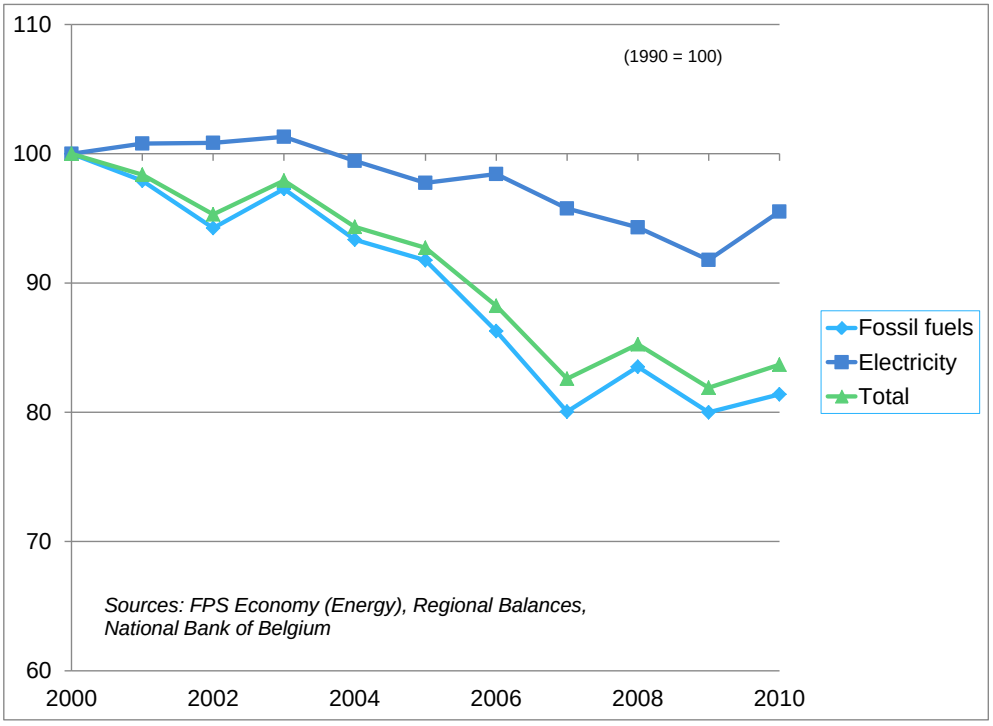
4.1.3 Energy intensity of GDP for fuels and electricity

On Figure 13, the energy intensity is calculated separately for two categories of energy carriers: fuels — which are often largely substitutable amongst each other, and may hence be considered jointly — and electricity, which is mostly tied to specific uses.

Overall, both intensities have been decreasing over the period. For electricity, the intensity has decreased by about 10% from 2003 to 2009. The rebound in 2006 may be due to an increase in electric steel production of about 800 kt. The rebound in 2010 is mainly due to a significantly increased consumption in the chemical industry.

For fuels, the energy intensity shows a generally decreasing trend, with some fluctuations.

Figure 13: Energy intensity of total final energy consumption

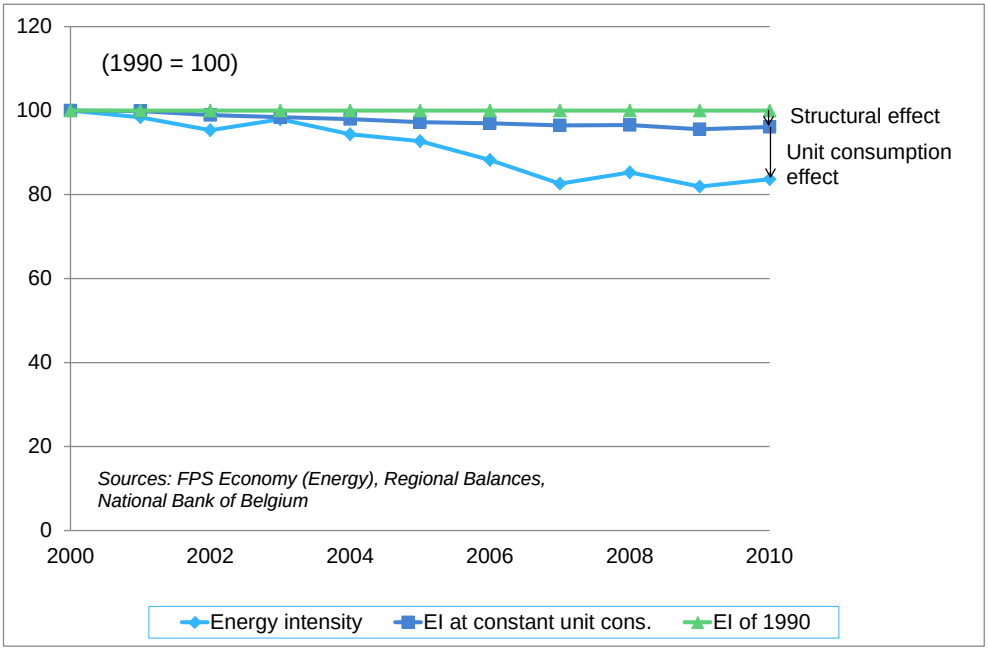


After climate correction

4.1.4 Impact of structural change

The reduction in energy intensity of GDP can be considered as the result of two different contributions: a structural effect and a unit consumption effect. One way of decomposing these two contributions is shown on Figure 14 (after climate correction).

Figure 14: Energy intensity and macroeconomic structural effect



On this figure, the unit consumption effect (a proxy for the energy efficiency effect) is the difference between the actual energy intensity and the energy intensity obtained by assuming that the four main sectors (industry, residential, tertiary, transport) keep their unit consumptions constant and equal to those of the year 2000.

The structural effect is the difference between the energy intensity at constant unit consumptions of 2000 and the energy intensity in 2000. It represents the effect of the relative change in importance between the sectors.

The way this structural effect is calculated is described in Annex 4.

Compared with 2000, the reduction in energy intensity reached in 2010, which amounts to 16%, consists for the major part of a unit consumption effect (of about 12%) and to a lesser extent to a structural effect (4%).

Actually, the unit consumption effect is itself partly influenced by structural effects happening within each of the four sectors, in particular by structural changes in industry.

The above overall analysis has limitations, because of its very aggregate level and the fact that the activity variables are imperfect, in particular for transport, where in absence of any better activity variable, the GDP has been chosen (which is standard practice). The results should therefore be interpreted with care.

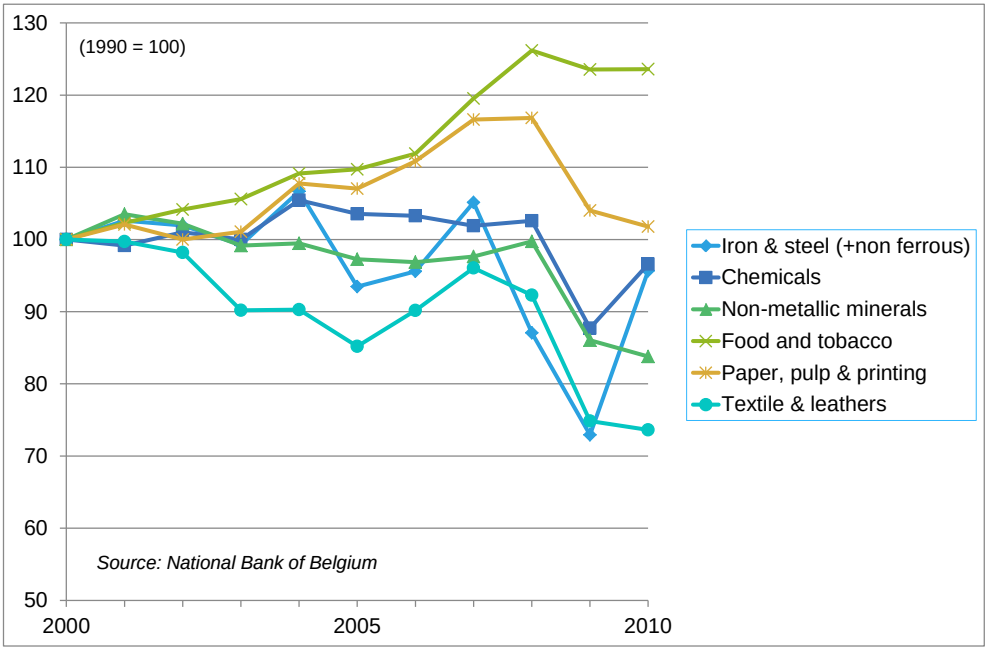
A better indicator of the actual energy efficiency would need to take structural effects into account at a more detailed level, and preferably use activity variables expressed in physical units. Such analyses are presented in section 4.6, page 41.

4.2 Industry

4.2.1 Overall context

Figure 15 shows the evolution of value added by main industrial branch since 2000. There is a significant dispersion across sectors, the food and tobacco sector having the largest growth, the textile industry the largest decline. One can immediately see the impact of the economic crisis, in 2009-2010, already in 2008 for the iron & steel industry (and non-ferrous metals). This impact also differs across sectors: textile, primary metals (iron& steel and nonferrous metals[3]), chemicals and paper all had a strong decline in 2009, while the food industry was only marginally affected; in 2010, only primary metals and chemicals recovered, which they did substantially.

Figure 15: Evolution of value added by industrial branch



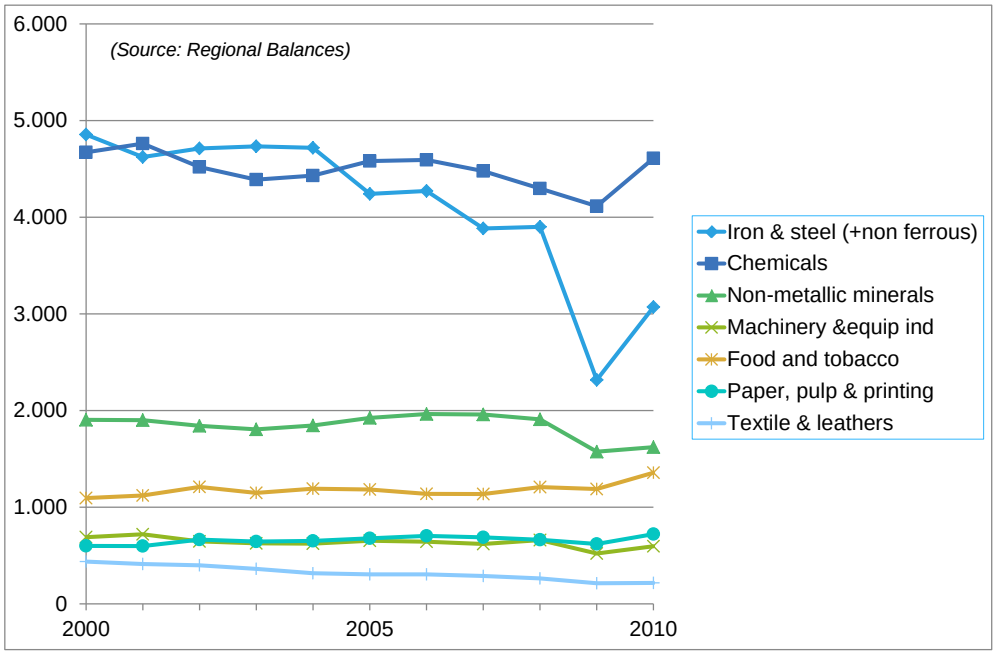
3 Iron & steel and nonferrous industries are kept together because the data on value added are not available anymore for each of these two branches individually.

4.2.2 Energy consumption trends

The development of energy consumptions by branch is shown on Figure 16.

By far the two largest consumers are iron & steel[4] and chemicals. The first has seen its consumption decline, and almost halved between 2008 and 2009 due to the crisis, and partially rebound in 2010. The consumption of the second has remained more stable overall, but with a regular decrease between 2006 and 2009, and a significant increase in 2010.

Figure 16: Energy consumption by industrial branch (ktoe)



The non-metallic minerals sector (essentially cement, lime and glass production) and the food & tobacco sectors, the next ones in terms of energy consumption, have had a pretty stable consumption over the entire period, except for 2009-10, where the first plummeted and the food industry grew instead.

Among the remaining sectors, the consumption of paper, pulp & printing has been increasing, while that of textile & leathers has lost importance.

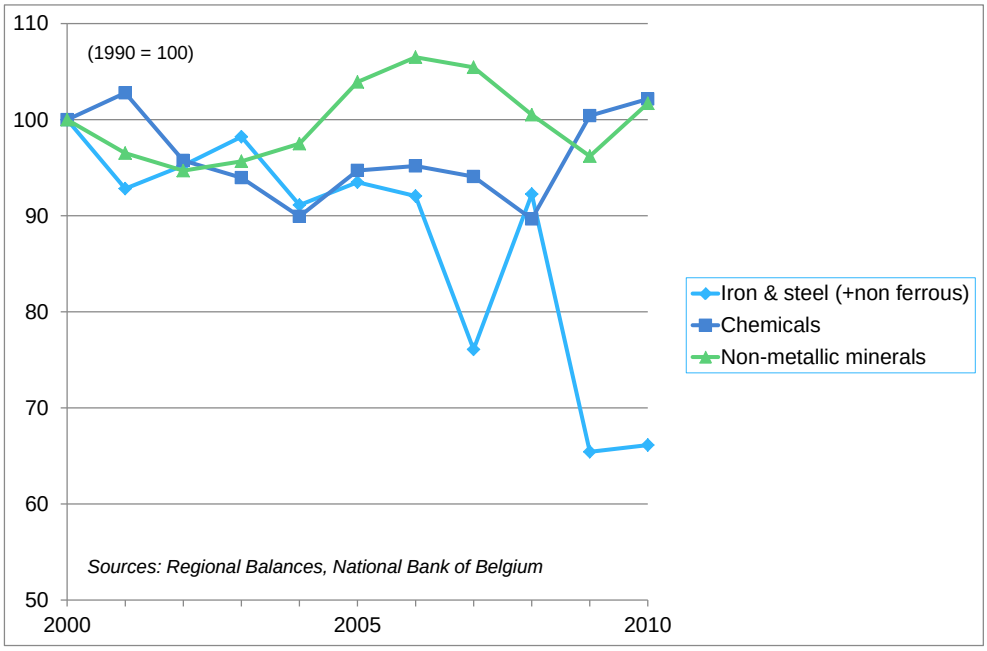
[4] As already mentioned, “iron & steel industry” includes nonferrous metals.

4.2.3 Energy intensity trends/Unit consumption trends

4.2.3.1 Energy intensities by branch

Figure 17 and Figure 18 show the evolution of the (final) energy intensity (total energy consumption/value added in 'constant prices'[5]) for the main industrial branches. They show some rather large fluctuations.

Figure 17: Evolution of energy intensity by industrial branch (1/2)

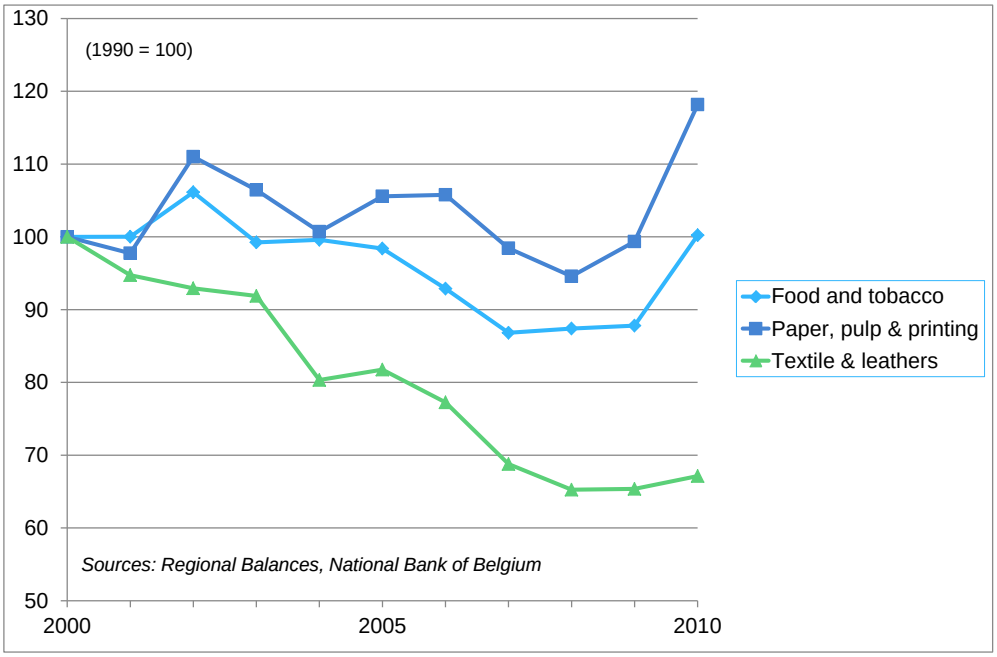


Overall, the energy intensity of the steel industry shows a downward trend, but it has a remarkable peak in 2008. This is due to the fact that the energy consumption remained the same, while the value added dropped by 17%. The non-metallic minerals sector has seen its energy intensity deteriorate between 2002 and 2006, after which the situation has improved, except in 2010. As to the chemical industry, its intensity has substantially worsened in 2009 and 2010, due to the drop in value added in 2009 and the increase in energy consumption in 2010.

5 Actually, the value added is expressed in chained euros, reference year 2010.

As far as the food, paper and textile sectors are concerned, Figure 18 shows that, after a period of stable or decreasing trend, all three have had their energy intensity significantly increased in 2009-2010.

Figure 18: Evolution of energy intensity by industrial branch (2/2)



4.2.3.2 Inter-branch structural effects

This section examines to what extent the evolution of the energy intensity of industry as a whole is the result of a structural effect within industry, i.e. a shift in weight between branches with different energy intensities.

The analysis of the intra-industry structural effects has been carried out taking into account the following 7 sectors:

- Iron & steel (+non ferrous),
- Chemicals,
- Non-metallic minerals,
- Machinery &equip ind,
- Food and tobacco,
- Paper, pulp & printing,
- Textile & leathers.

The “other industrial sectors” are not included, because they are too heterogeneous. These 7 sectors actually represented 84% of the total energy consumption of industry in 2000.

On Figure 19, the variation in energy consumption since 2000 has been separated into three effects: an activity effect, a structural effect and a unit consumption effect.

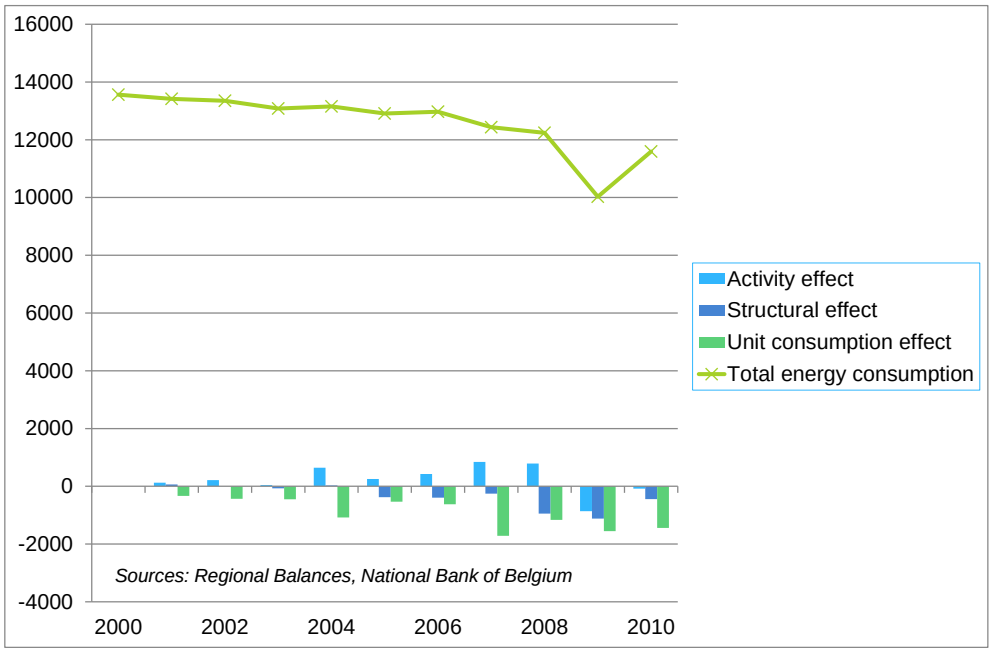
The activity effect is the evolution of energy consumption that would have been observed if the unit consumptions had remained those of the base year 2000. The activity variable taken into account for each sector is the value added at constant prices (i.e. in chained euros). The unit consumption effect for each sector is calculated as the difference between the actual energy consumption and the energy consumption that would have been obtained had the energy intensity remained equal to that of 2000.

One can see that the largest contribution to the variation in energy consumption since 2000 comes from the unit consumption effect.

The second effect by size is the structural effect, which was largest in 2009.

Over time, there has been first a positive and later a negative activity effect, but in 2010 this activity effect has disappeared.

Figure 19: total energy consumption in industry and variation since 2000



It should be remembered that the structural effect is calculated using the energy intensities of the reference year, in this case 2000. The results are sensitive to the choice of that reference year.

It should also be remembered that this analysis remains approximate, because the activity variable used (value added) is only an imperfect indicator of the activity level of each sector. This is also why unit effects are influenced by intra-branch structural effects, and therefore only imperfectly represent the evolution of energy efficiency.

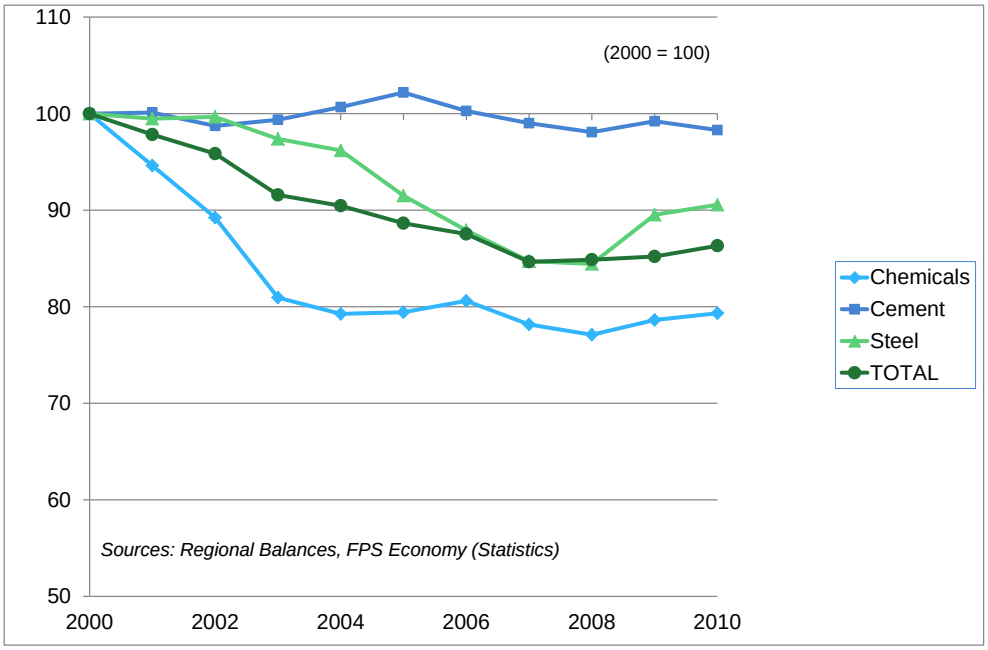
Moreover, the results obtained are sensitive to the choice of activity variable. The picture would have been different if the industrial production index had been used instead of the value added (e.g. in the chemical industry the industrial production index has historically increased more slowly than the value added).

4.2.4 The ODEX indicator for industry

The ODEX indicator aims at better estimating the technical energy efficiency. It is the subject of section 4.6, but for reasons of completeness we also include the indicator in the analysis of each sector.

Figure 20 shows the evolution of the ODEX indicator for three main branches and for industry as a whole for the period 2000-2010.

Figure 20: Industry ODEX



As explained in 4.6.3, the overall indicator has been calculated using a disaggregation in 9 branches.

One can notice a significant and regular improvement of energy efficiency, reaching 17% over the period 2000-2007, for the overall indicator, after which there has been a stabilisation, and even a small increase in the indicator (reflecting a worsening of the efficiency).

The three branches represented on the graph show quite different evolutions: an overall stabilisation for the cement sector; a strong decrease (20%) from 2000 to 2003, followed by a stabilisation, for the chemical sector; and an up to 15% decrease until 2007, followed by an increase in 2009 and 2010, for the steel sector.

4.3 Households

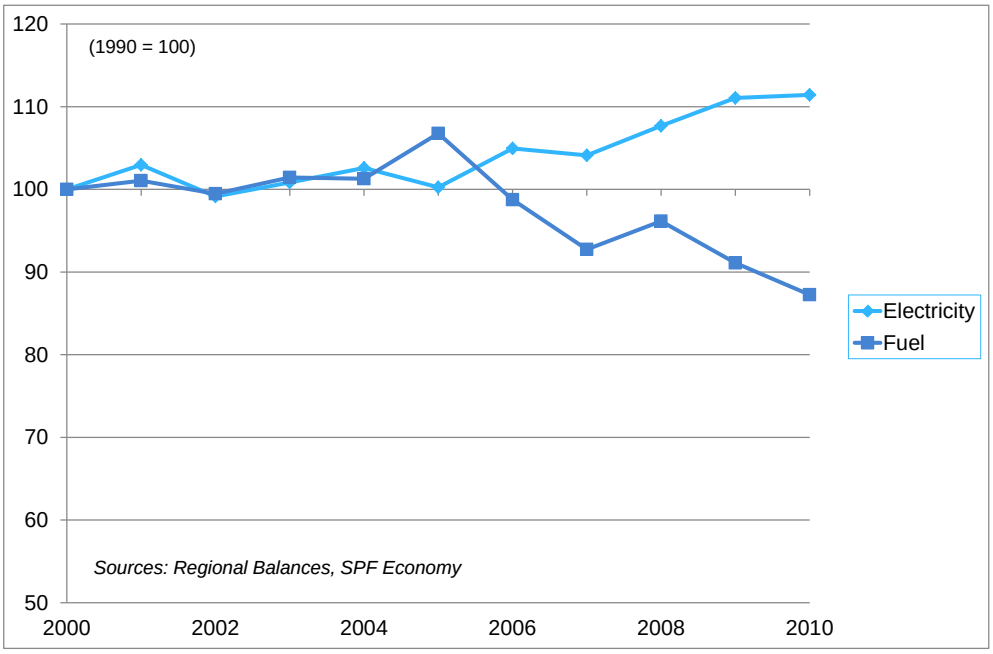
4.3.1 Consumption per inhabitant

Per inhabitant, the (climate corrected) fuel consumption of households has reached a peak in 2005, and has significantly decreased thereafter, except in 2008. On the other hand, the electricity consumption per inhabitant has remained stable until 2005, after which it has significantly increased.

The official (federal) statistics on energy consumption for the residential sector are only disaggregated by fuel, not by type of use (space heating, water heating or other uses). This limits the possibilities to calculate indicators.

In this sector fuels and electricity are substitutes, and the penetration of electric heating is significant. Therefore the total energy consumption has been considered instead of the sole fuel consumption.

Figure 21: Residential energy consumption per inhabitant (after climate correction)

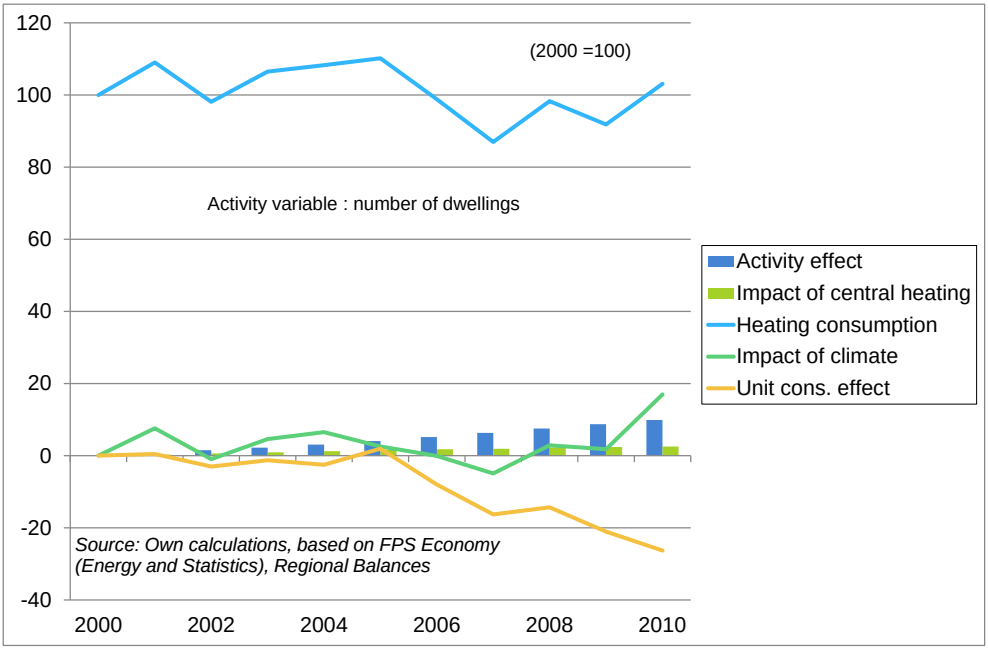


4.3.2 Decomposition of the trend in energy consumption for space heating

Figure 22 decomposes the evolution of the energy consumption for space heating since 2000 in the following components:

- the impact of an activity variable, chosen here as the number of dwellings;
- the impact of the climate (derived from the number of degree-days);
- the impact of the increased penetration of central heating (which tends to increase the energy consumption);
- the unit consumption effect, corresponding to energy savings.

Figure 22: Residential energy consumption for space heating and variation since 2000



The activity effect is regularly rising and reaches 9,9% in 2010. The impact of central heating is also regularly rising, but much smaller, contributing to an increase in energy consumption of 2,5% in 2010.

As to the climate effect, it shows rather large variations, and reaches 17% in 2010. It is the main factor explaining the higher fuel consumption in 2001 and 2010.

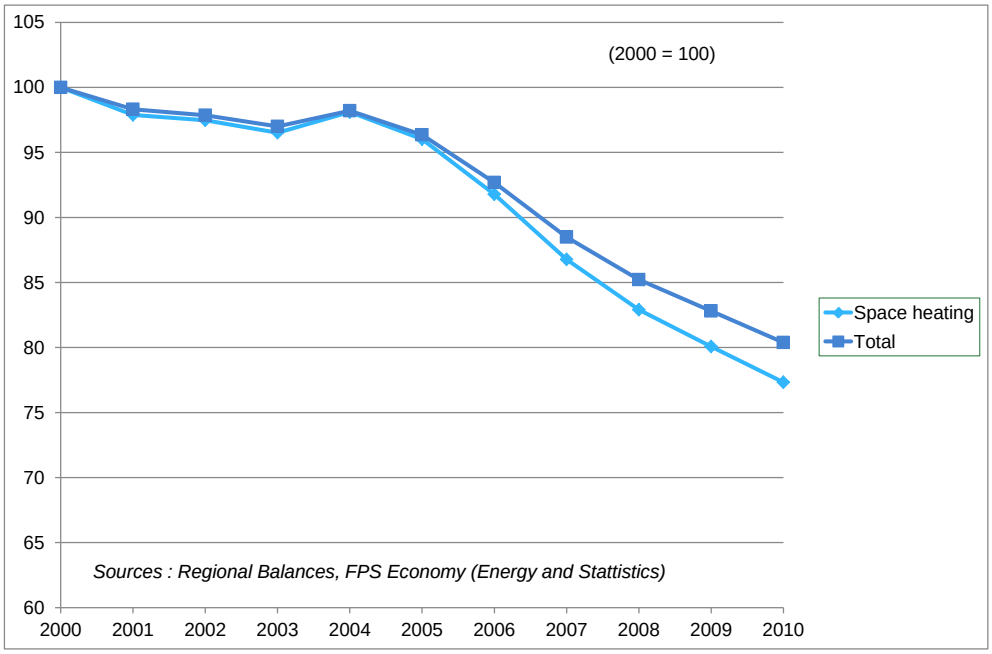
The unit consumption effect, which is calculated as a residue, can be interpreted as representing the energy savings, including behavioural effects such as reducing indoor

temperatures, for example as a reaction to higher energy prices. The graph shows energy savings only starting in 2006 but reaching the substantial value of 26% in 2010.

4.3.3 The ODEX indicator for the residential sector

Figure 23 shows the evolution of the ODEX indicator for the households sector.

Figure 23: Households ODEX



It is calculated as the average energy consumption per dwelling, after correction for the number of degree-days and the increased penetration of central heating. See section 4.6.1 for further comments on it.

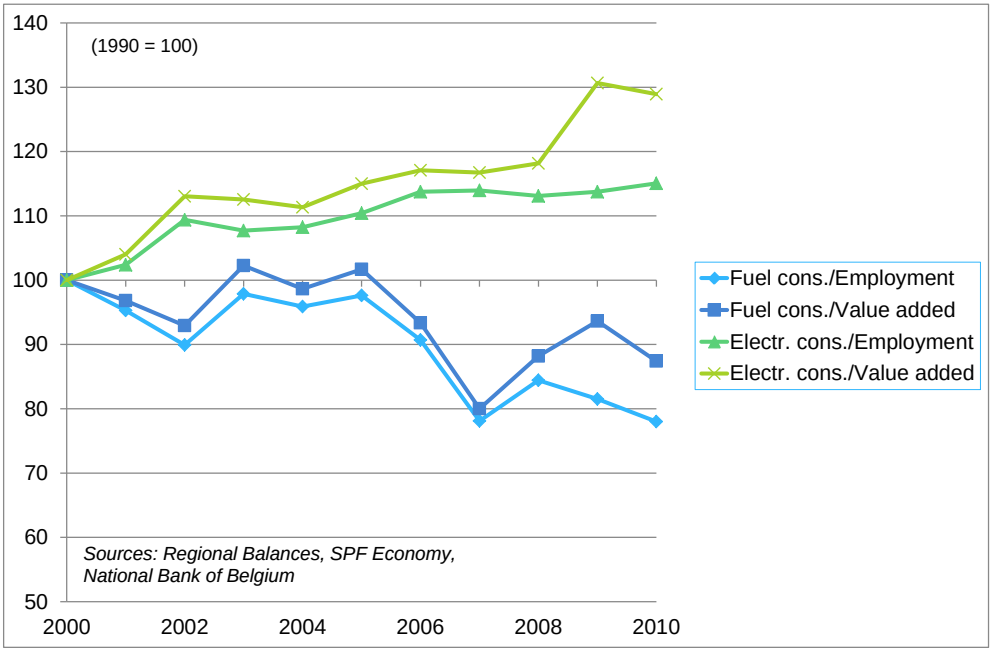
4.4 Services

4.4.1 Unit consumptions

For the tertiary sector different activity variables can be considered. Figure 24 shows the evolution of the energy consumption[6] per employee and per unit of value added, for fuels and for electricity.

The results depend on the type of activity variable, as the value added has increased more quickly than the number of employees. But the largest difference is between fuels and electricity. For the fuel consumption, the indicators fluctuate, but there is an overall downward trend. Whereas for electricity, the unit consumptions have been increasing regularly, though less per employee than per unit of value added.

Figure 24: Tertiary sector - Ratio Energy consumption/Activity



[6] After climate correction.

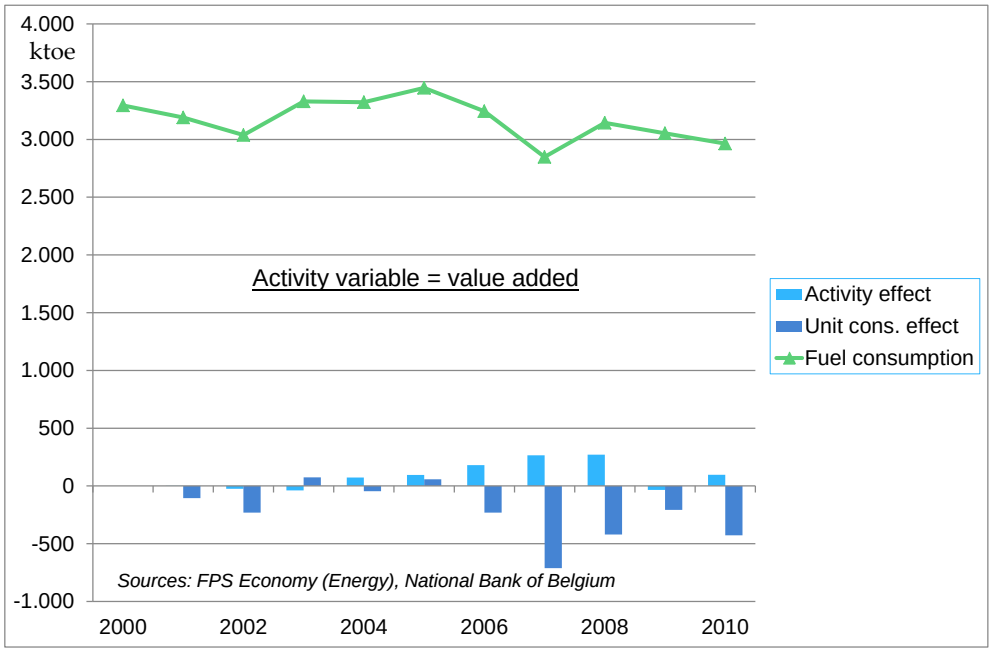
4.4.2 Decomposition of fuel consumption

The decomposition analysis on Figure 25 is similar to that made for the residential sector, except that the consumption of fuels has been considered in isolation. Indeed, as there is hardly any electricity consumption for space heating in the tertiary sector, fuels and electricity have been considered separately.

Up to 2005, the fuel consumption has continued, though at a slower pace, the rising trend of the nineties. Since then, however, it has significantly declined.

The activity variable used for the decomposition is the value added of the sector. As for the residential sector, the main impact is that of the unit consumption effect, i.e. a reduction in the fuel consumption per unit of value added. In 2010, the activity effect has become very small, because of the economic crisis.

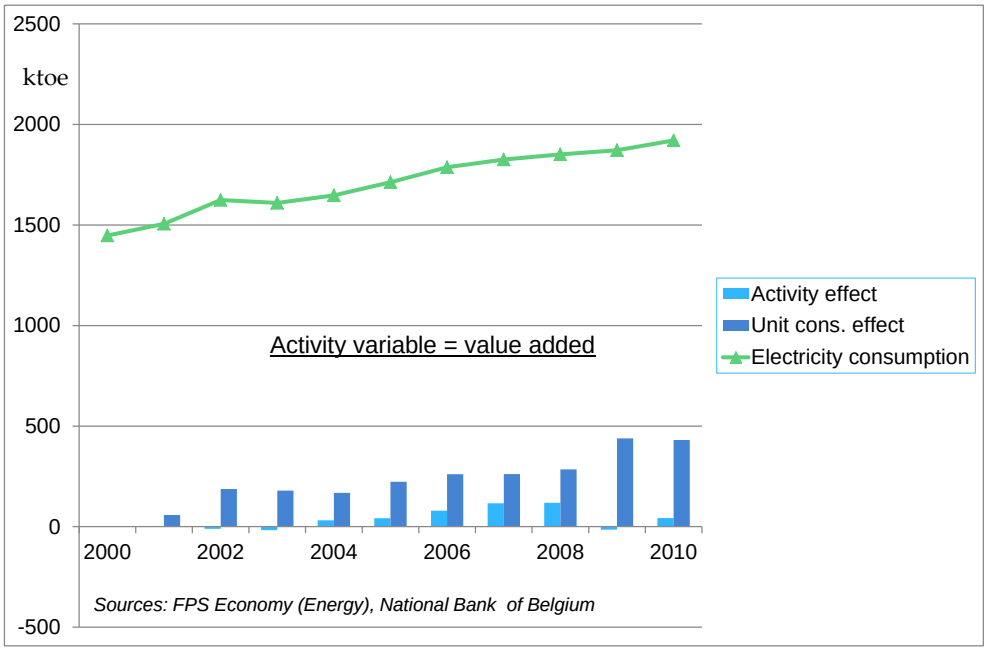
Figure 25: Fuel consumption in tertiary sector and variation since 2000



After climate correction

For the electricity consumption, displayed on Figure 26, one can notice that since 2000 the main effect is the unit consumption effect (it was already the dominant effect in the nineties), likely to result from the increasing use of new applications of electricity, amongst which computer and other office equipment).

Figure 26: Electricity consumption in tertiary sector and variation since 2000



4.5 Transport

4.5.1 Passenger transport

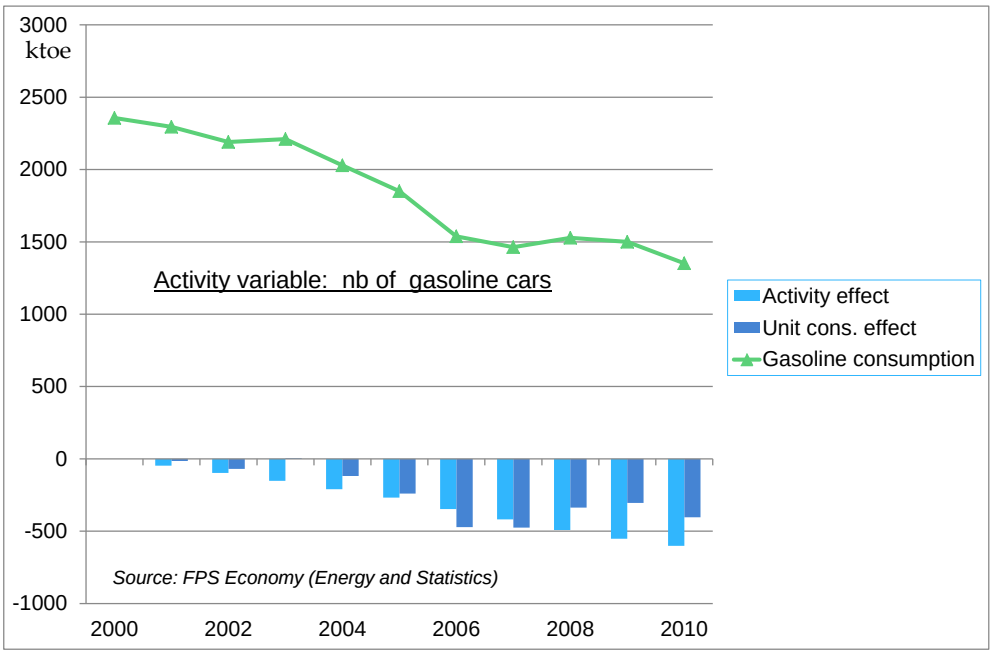
4.5.1.1 Analysis based on the number of cars

The federal energy statistics don't disaggregate the fuel consumption for road transport by type of vehicle (cars, trucks…). However, as gasoline cars account for over 90% of total gasoline consumption, it makes sense to compare the evolution of the number of gasoline cars with the total gasoline consumption.

The gasoline consumption, which remained flat until 1995, has since followed a steadily decreasing trend.

This evolution can be decomposed between an activity effect and a unit consumption effect, which is done one Figure 27, where the activity variable used is the number of gasoline cars. This figure shows that the decrease in fuel consumption since 2000 is mainly due to the activity effect (decrease in number of vehicles), but also to a significant extent to the unit consumption effect (average gasoline consumption by car).

Figure 27: Gasoline consumption in road transport and variation since 2000



For road transport by diesel vehicles such an analysis is not possible, because of the missing data on the energy consumption of diesel cars.

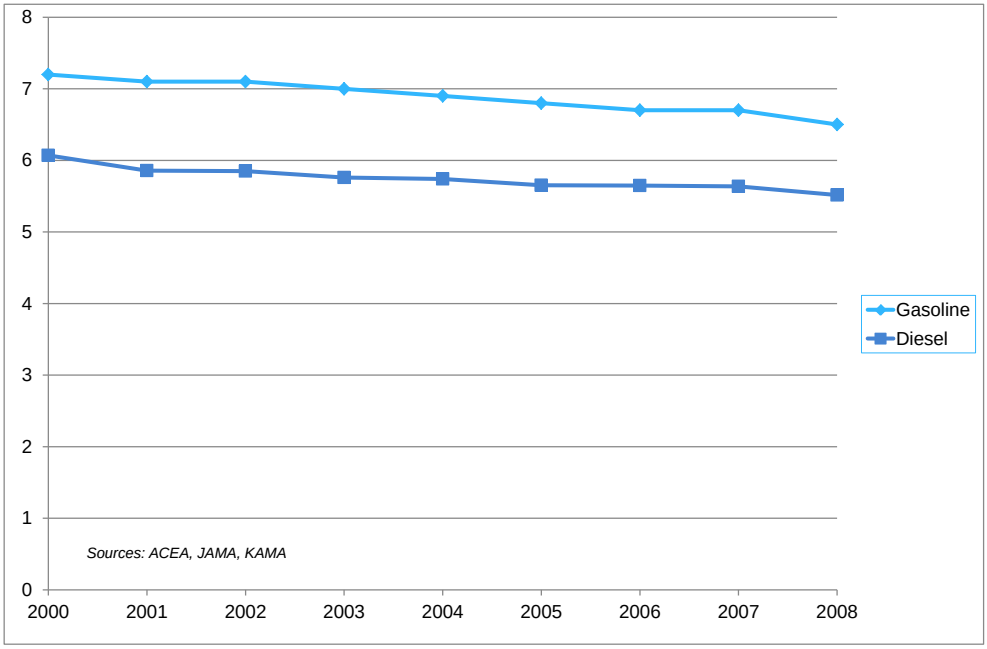
Given the nature of the activity variable, the unit consumption effect includes both a specific consumption (l/100 km) effect and an average mileage effect. The decrease in average mileage, which is quite substantial, can probably be explained by the shift of from gasoline to diesel, which is likely to have occurred mostly for the highest mileages, thereby reducing the average mileage of gasoline cars.

The data does not allow to distinguish between the contribution of behaviour (in particular the average mileage) and that of efficiency improvement.

4.5.1.2 Specific fuel consumption of new cars

Figure 28 shows the evolution of the average normalised specific consumption of new cars, based on the test cycle of Directive 93/116/EC. The data, from ACEA (obtained through the Odyssee website and only available until 2008), represent the average for the Belgian market of cars manufactured by members of the European, Japanese and Korean automobile construction associations (ACEA, JAMA and KAMA).

Figure 28: Average specific fuel consumption of new cars (l/100 km)



There has been a significantly decreasing trend in average fuel consumption of both gasoline and diesel new cars sold. For diesel cars, the decrease is less important, which could be explained by the shift from gasoline to diesel cars, which rather took place for the largest of the gasoline cars.

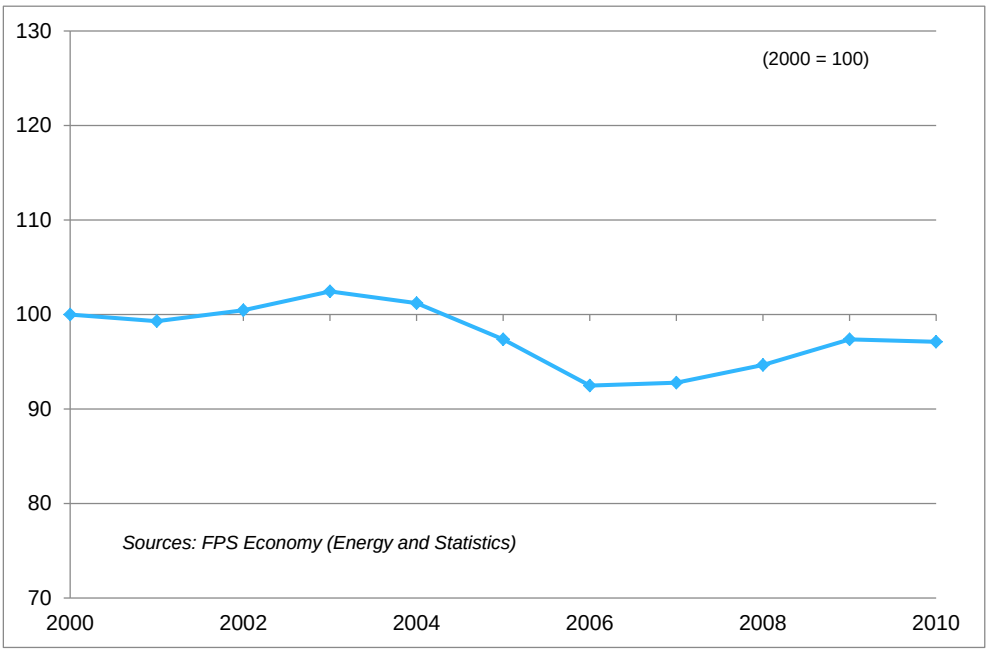
4.5.2 Freight transport

The total consumption of diesel fuel is known, but it cannot be used here, because a large fraction of it (about one third) is used in diesel cars, and this fraction varies from year to year according to factors that are not quantified (amongst which in particular the average mileage of diesel cars). Therefore it is not possible to split into its different components the fuel consumption for freight transport by road.

4.5.3 The ODEX indicator for transport

The figure below shows the ODEX indicator for the transport sector.

Figure 29: Transport ODEX



This indicator takes into account the road, rail and air transport modes, for both passenger and goods transport. For road transport, it represents the evolution of the average energy consumption per vehicle or per passenger. See further comments in section 4.6.2.

4.6 Assessment of energy efficiency/savings through ODEX: total and by sector

A conventional way of measuring the overall energy efficiency improvement of a sector is to use the energy intensity (energy consumption divided by value added or GDP). However this indicator is influenced not only by technical efficiencies, but also by structural changes within the sector, such as a shift from energy intensive towards less energy intensive products.

The ODEX indicator, which has been developed in the framework of the ODYSSEE project, aims to better reflect the evolution of the technical efficiency of energy use of a sector, at whatever aggregation level.

This indicator is a kind of weighted average of unit energy consumptions of elementary components of the sector, based as far as possible on activity variables expressed in physical units instead of in monetary terms[7]. Of course it implicitly takes into account the impact of all energy saving measures (whether or not policy driven), including technical progress and behavioural changes.

It should be noted that all the ODEX indicators used in this report are 3-year moving averages, which has as effect to smooth the curves.

Within the ODYSSEE project, for the residential sector a "technical ODEX" has also been defined , which differs from the ordinary ODEX indicator in that it aims to remove behavioural factors[8]. However such a technical ODEX has not been used in this report[9].

As for the other countries in the project, no ODEX indicator could be calculated for the tertiary sector, because of a lack of required data.

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7 A description of ODEX can be found in:

"Definition of the energy efficiency index ODEX" (www.odyssee-indicators.org).

Bosseboeuf D.: "Measuring energy efficiency progress in the EU: the energy efficiency index ODEX", presentation at ECEEE Summer Study 2005.

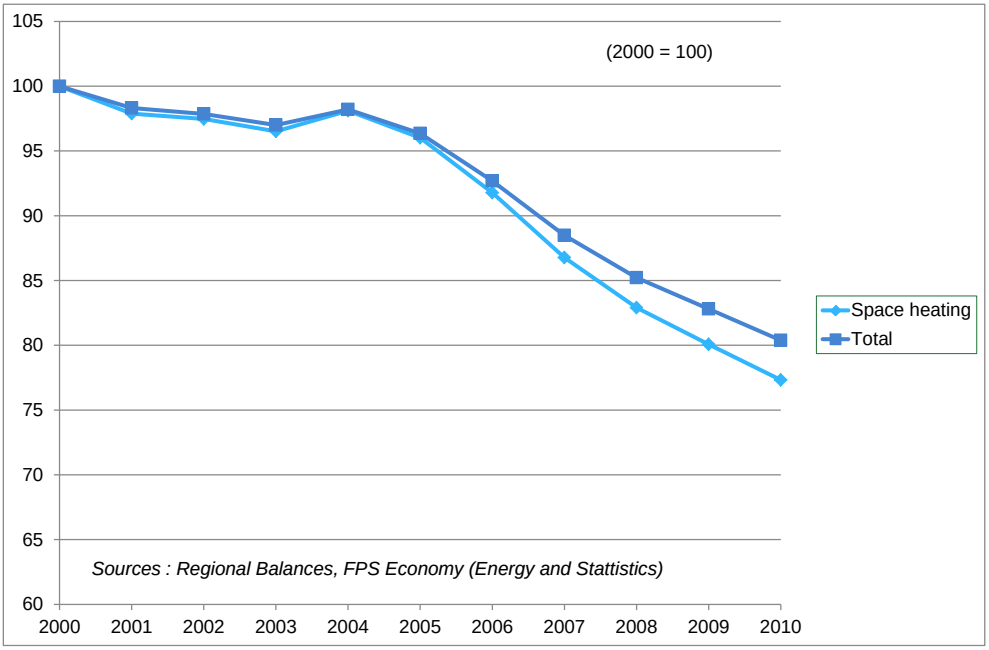
8 See "Definition of the energy efficiency index ODEX" (www.odyssee-indicators.org).

9 The reason for not using the technical ODEX is that it has the drawback of taking into account behavioural effects with a negative sign (reducing the consumption, e.g. in a context of higher energy prices) in the same way as technical improvements, while neglecting behavioural effects with a positive sign (e.g. an increase in energy consumption as a result of decreasing energy prices).

4.6.1 Residential

For the residential sector, the ODEX indicator is calculated as the average fuel consumption per dwelling, after correction for the number of degree-days and the increased penetration of central heating.

Figure 30: Households ODEX



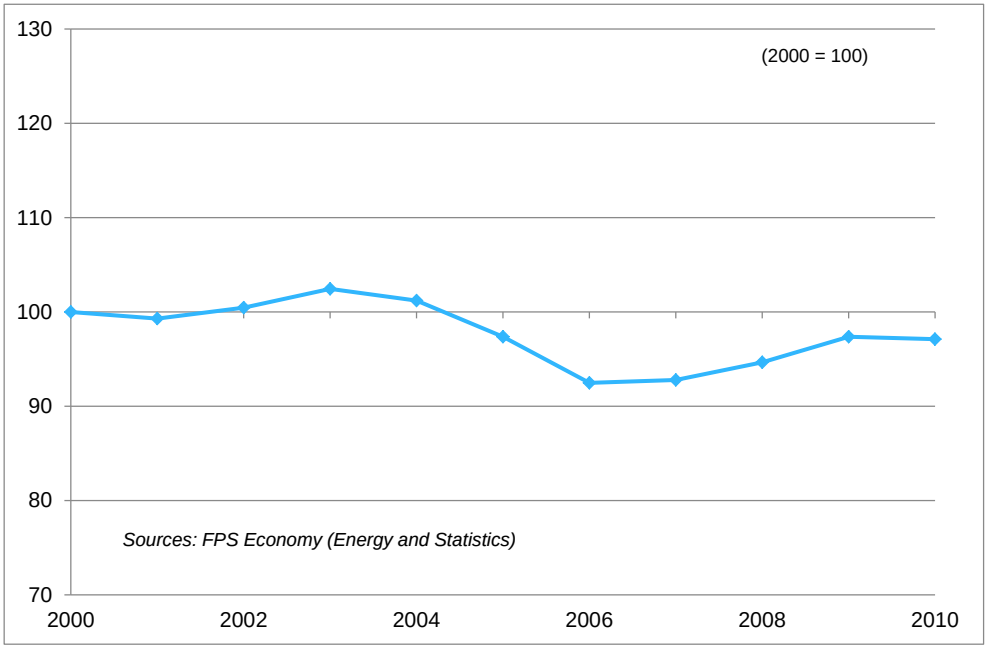
During the previous decade, between 1994 and 1997, the index had increased, which can probably be attributed to changes in “lifestyle”, an increase in comfort (higher indoor temperatures, less caution with the use of energy, more appliances…)[10]. Since then there has been significant decline in the energy efficiency index, amounting to 20% between 2000 and 2010, which could be explained by technical progress and equipment renewal, policy driven savings and increasing energy prices.

10 It should be noted that during the period 1995-2000, the average fuel consumption per dwelling has increased in most EU countries, as well as for the EU-15 as a whole.

4.6.2 Transport

The ODEX indicator for transport, shown on Figure 31, is only a rough indicator. It takes into account only road, rail and air transport. For road transport, given the lack of data on the vehicle fleets' average specific consumptions, it represents the evolution of the average annual fuel consumption per vehicle, and is thus influenced as well by the average vehicle mileage as by the specific consumption (in l/100 km) of the vehicles.

Figure 31: Transport ODEX



Besides, because of a lack of disaggregation of the energy consumption data between types of vehicles, the various types of road vehicles are taken into account in a simplified way, on the basis of car equivalents[11].

For river transport, the official energy consumption statistics are not enough reliable.

11 Converting the actual stock of vehicles into a stock of car equivalents is based on a coefficient reflecting the difference in average annual consumption between each type of vehicle and the car. If, for instance, a motorcycle consumes on average 0.15 toe/year and a car 1 toe/year, one motorcycle is considered to be equal to 0.15 equivalent cars ("Definition of the energy efficiency index ODEX", www.odyssee-indicators.org). The conversion coefficients used are 0,15 for motorcycles, 15 for buses and 4 for trucks and light vehicles.

One can notice that over the period 2000-2010 the indicator has been fluctuating. It decreased by 10% between 2003 and 2006, but increased by 5% between 2006 and 2009, and eventually reached a reduction of only 3% in 2010 compared to 2000. The rise since 2006 is mainly due to the fact that the energy consumption for road transport has increased faster than the stock of vehicles over that period.

4.6.3 Industry

The ODEX indicator for industry has been calculated using the following 9 branch disaggregation:

- Iron & steel,
- Non ferrous metals,
- Chemicals, rubber & plastics
- Cement
- Other non-metallic minerals,
- Paper, pulp & printing,
- Food and tobacco,
- Equipment manufacturing
- Textile & leathers,

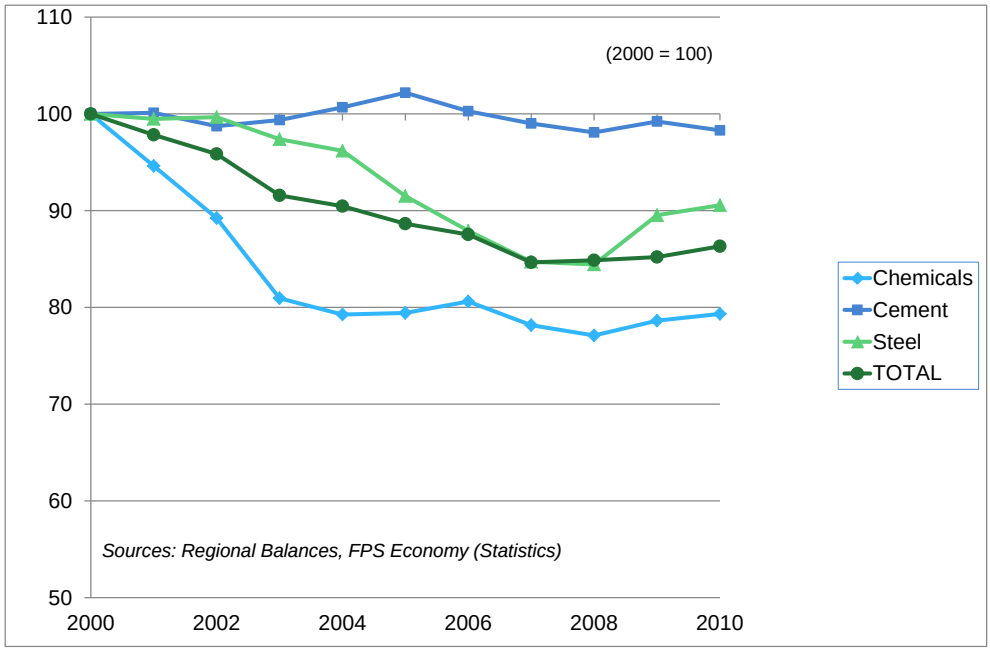
using as activity variable the physical production of steel, cement and paper, and the industrial production index for the remaining sectors.

As is explained in Annex 3, the quality of federal energy consumption statistics by individual industrial branch appears to be poor. Therefore, instead of using these figures, we have aggregated the energy consumption statistics of the three Regions[12].

12 Even though these regional statistics may not be completely harmonised.

Figure 32 is the same as Figure 20, showing the ODEX for industry as a whole as well as for three energy intensive industrial branches.

Figure 32: Industry ODEX

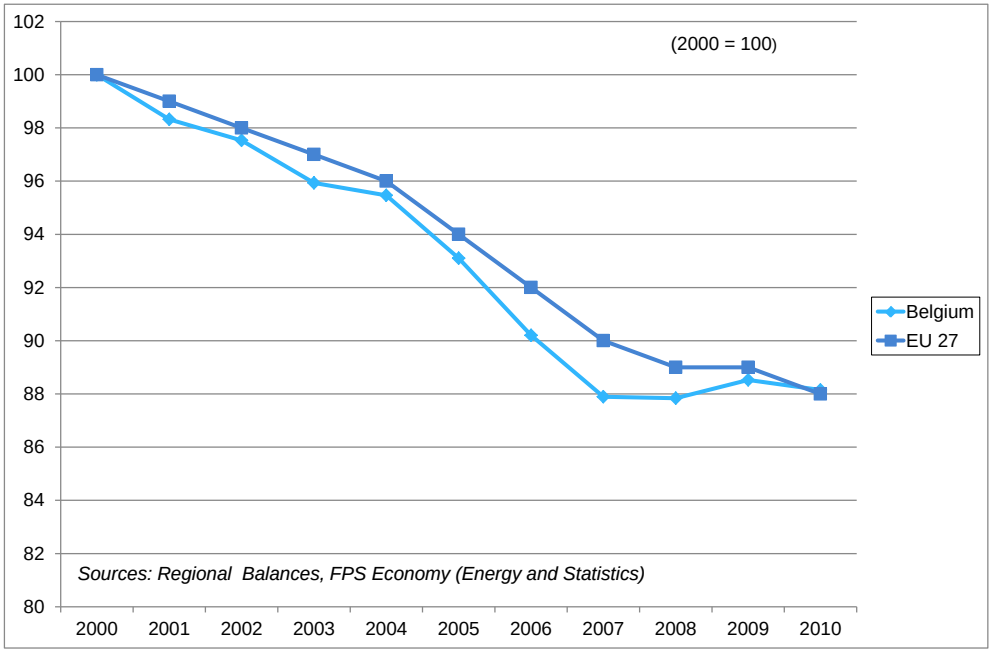


From 2000 to 2003, the indicator for the chemical industry has diminished by 20%. This is probably to be explained more by structural effects within the branch than by energy efficiency improvements; indeed, the more detailed data available in the framework of the voluntary agreements in both Flanders and Wallonia (see section 4.4.2) tend to show that the reduction of specific energy consumption has not exceeded a few per cent. This shows the limits of the indicator when it is calculated at the aggregation level of a sector like the chemical industry as a whole.

4.6.4 The overall ODEX indicator

Figure 33 shows the overall ODEX indicator for Belgium and for the EU-27. This indicator takes into account the industry, residential and transport sectors, and is based on the ODEX indicator of each of these sectors, which have been presented above.

Figure 33: Global ODEX

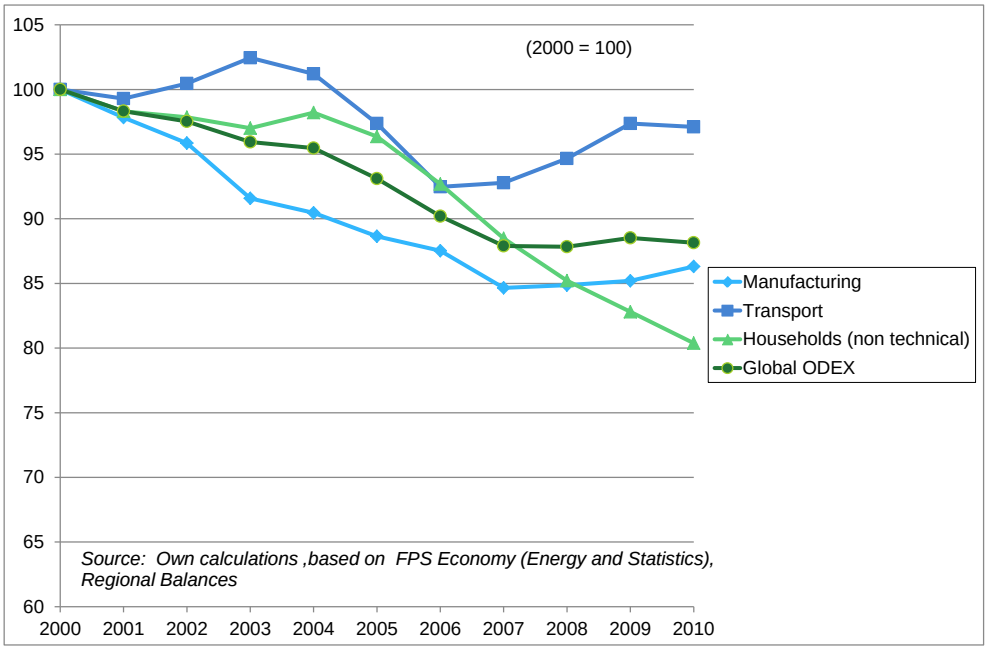


Note that this indicator should be improved in the future, as far as the disaggregation level and the choice of unit consumption indicators is concerned. The tertiary sector is not taken into account for any country because of a lack of adequate data.

Compared with the year 2000, this indicator shows a 12% improvement in energy efficiency, which is an average of 1,8% per year. The same is true for E-27. The stabilisation in 2008 and increase in 2009 is due to the transport sector.

The ODEX indicators of the different sectors are shown together on Figure 34.

Figure 34: ODEX indicator by sector

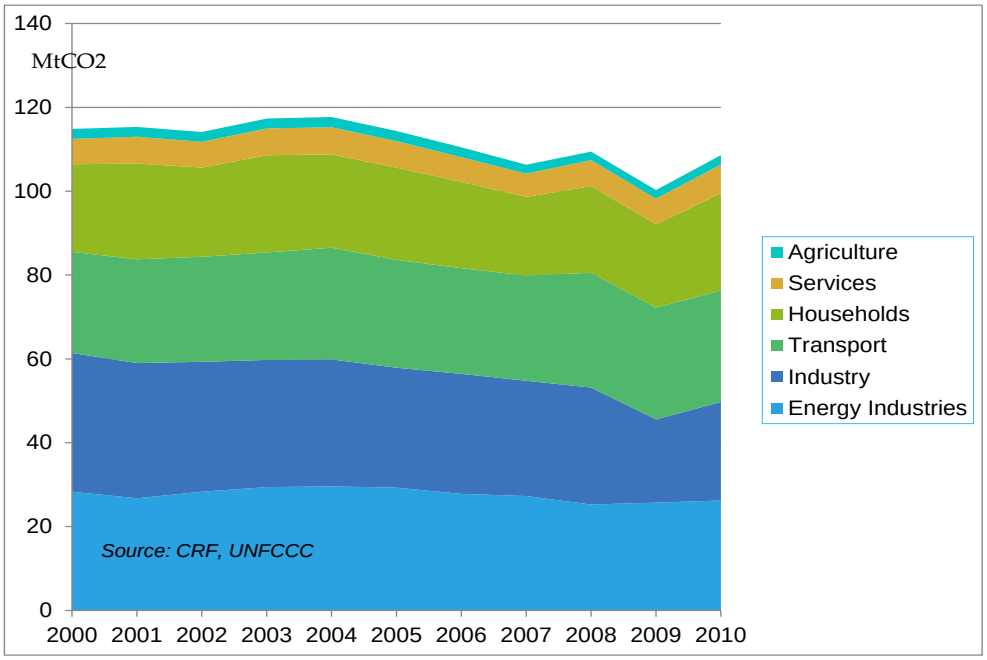


Since 2000, the largest improvement has taken place in the residential sector, which has overtaken industry in 2009. The caveats mentioned above about these indicators should be kept in mind when considering the comparison.

4.7 CO2 emission trends

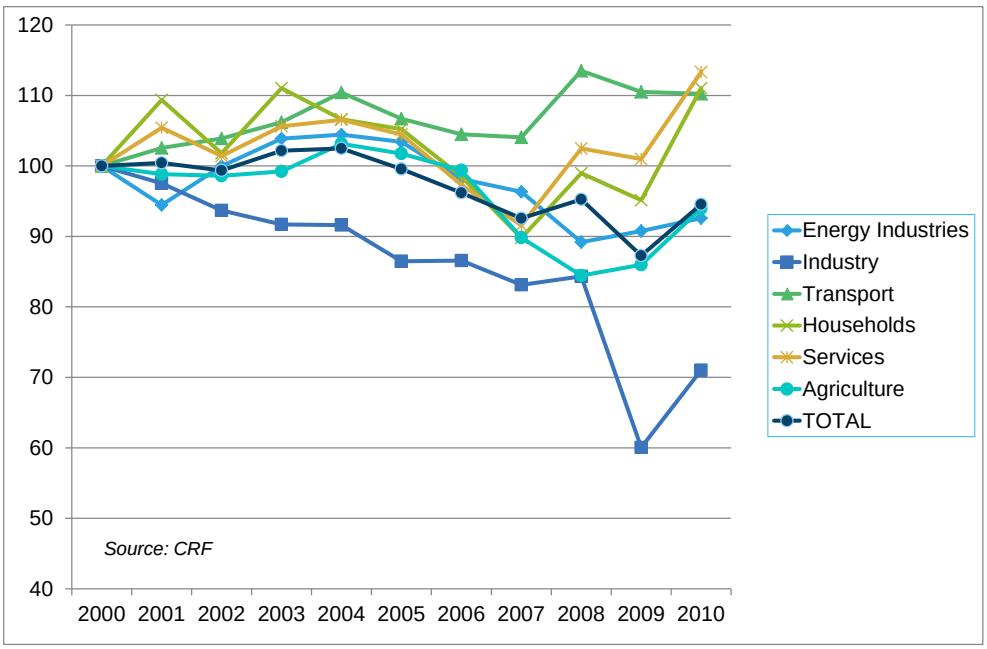
Overall, emissions have been decreasing, but with a rise in 2008 and a dip in 2009, due to the crisis.

Figure 35: Cumulated CO2 emissions by sector



As shown on Figure 36, the evolution differs according to the sector.

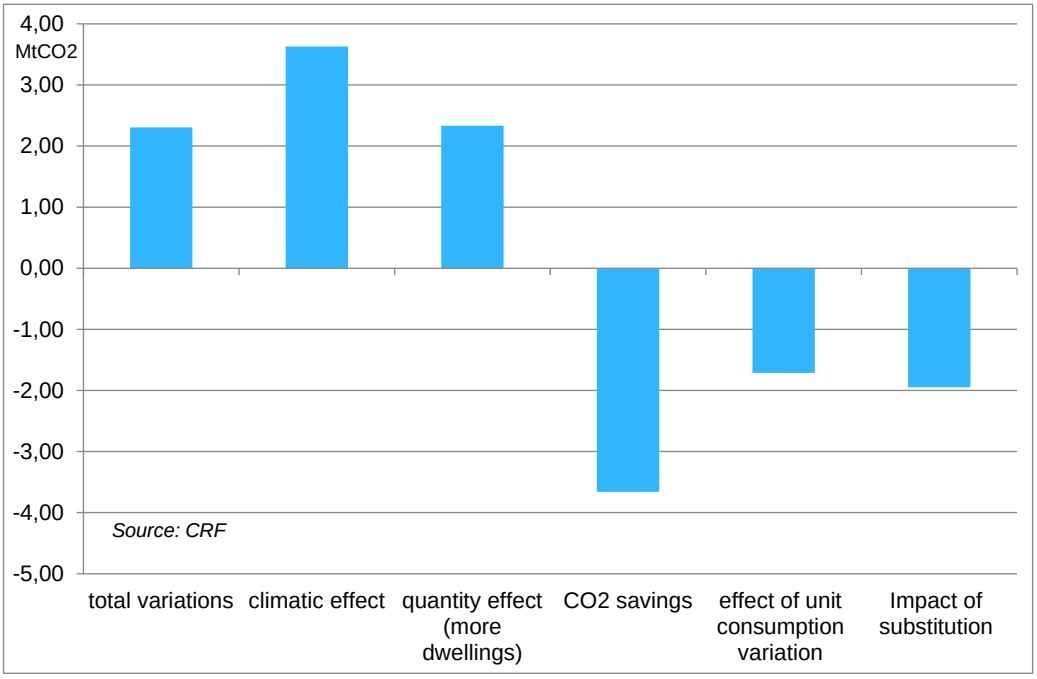
Figure 36: Evolution of CO2 emissions by sector



Industry is decreasing the most and, except in 2010, transport is rising the most. Transport is is the only sector with emissions going down in 2010.

The next figure shows a decomposition of the total variation of CO2 emissions between 2000 and 2010 for the households sector.

Figure 37: Interpretation of CO2 emissions variations (households - 2000-2010)



This total variation can be decomposed in:

- the climatic effect (3,6 Mt CO2);
- the quantity effect (2,3 Mt CO2, due to the increased number of dwellings);
- the CO2 savings.

The CO2 savings (3,7 Mt CO2) in turn comprises two components:

- the impact of substitution (essentially from gasoil to natural gas) is quite significant (1,7 Mt CO2);
- the unit consumption effect (1,2 Mt CO2); this represents the savings arising from the fact that new dwellings built since 1990 consume less energy than the average existing ones in 1990.

5 Energy efficiency measures

The individual policy measures with their main characteristics have been updated in the MURE database on energy efficiency measures[13], which is available at www.mure2.com. The following analysis is based on this database. The database focuses on the most important measures. A list of these measures is given in Annex 1.

In principle, only national measures are to be taken into consideration in the MURE database. However, according to the Guidelines[14], the database is also supposed to represent the measures of the second NEEAP[15], using for each the title appearing in the English translation of the NEEAP by the European Commission. Therefore in the case of Belgium, where most measures stem from the Regions, the regional measures have also individually been taken into account. According to the case, the name of the region (Flanders, Wallonia, Brussels) or "Federal government" is mentioned as the beginning of the title of each measure.

EU-wide measures which are common to all EU Member States (mainly EU directives) are flagged as such in the database.

5.1 Recent Energy Efficiency Measures

In 2010, Belgium submitted its second National Energy Efficiency Action Plan (NEEAP) in the framework of EU directive 2006/32 on energy end-use efficiency and energy services. This plan compiles the individual plans of the federal government and the three Regions (Flanders, Wallonia and Brussels-Capital). It describes the energy efficiency policy measures taken by the relevant federal or regional authorities and provides an estimate of the impact of the measures.

5.1.1 Buildings sector

In the buildings sector (residential en tertiary sectors), an important measure is the Energy Performance of Buidings (EPB) directive (directive 2002/91) and its recent recast (directive 2010/31). The transposition of the first in each of the three regions enforces

13 It should be noted that the update has been carried out up to, and including, the second NEEAP, which means in particular that the significant changes that took place in 2012 in Flanders (e.g. disappearance of grants for roof insulation) are not taken into account.

14 Fraunhofer ISI, *Guidelines for the measure description in the MURE Database*, Version 3.1, October 2011.

15 National Energy Efficiency Action Plan, established in the framework of EU directive 2006/32.

ambitious minimum performance standards for new buildings, with various deadlines, ultimately leading to zero energy buildings at the latest in 2020. The transposition of the second, which is still under way, will among other things reinforce the requirements for the renovation of existing buildings.

In Wallonia, important new measures are measure B28 in the Households sector and B27 in the Tertiary: "Wallonia - Potential impact of AEE (Employment Environment Alliance)". These measures correspond to the Plan pluriannuel de la 1ère Alliance Emploi-Environnement, adopted by the Walloon Government in September 2011, which aims at improving the quality and the energy performance of the existing building stock while reorienting the building sector towards a more sustainable approach and reinforcing its employment level.

Specific objectives of this plan are threefold: to stimulate the demand for renovation/sustainable construction of private and public buildings, and to stimulate the capacity of the building sector to meet this demand. In the framework of this plan, besides grants, zero interest rate loans are being awarded, to households for global energy performance renovation investments.

In Flanders, a reduction in property tax is awarded since 2009 for new buildings that perform significantly better than the compulsory energy performance standards (measures BEL24 for Households and BEL19 for Tertiary).

The Brussels region is considering making energy audits mandatory for any building of more than 3500 m² not allocated to housing upon renewal of its environmental permit (measure BEL15 in Tertiary).

Another measure considered for the Tertiary sector in Brussels is the obligation to establish a plan for the reduction of energy consumption on major consumers ("PLAGE": Local Action Plan for Energy Management).

5.1.2 Transport Sector

In the transport sector, the increase in energy efficiency of cars is being promoted by Regulation 443/2009 of the European Parliament and of the Council of 23 April 2009, which sets limits to average CO2 emissions per car for the cars put on the market.

At national level, efforts have been made to go beyond these limits through financial incentives: tax rebates from the Federal government and a bonus/malus system in the Walloon region. However the federal tax rebates have been stopped on 1st January 2012, for budgetary reasons, and the Walloon bonus/malus system has been revised.

5.1.3 Industrial Sector

For industry, the energy efficiency policy has been focussed on voluntary agreements between industry and the (regional) governments.

In Flanders, the voluntary agreements are “benchmark” agreements, with a commitment to bring the energy efficiency to the world top ten by 2012. They are signed by individual companies with an energy consumption larger than 0,5 PJ per year. By August 2009, 182 companies had signed such an agreement, next to 12 sector organisations.

In Wallonia, the existing voluntary agreements are coming to an end in December 2012. New agreements for the period until 2020, which will be of a new type, are currently being negotiated.

5.2 Innovative Energy Efficiency Measures

Most of the implemented policy measures are well-known types of measures that can also be found in other countries: fiscal deductions, subsidies, building thermal regulations, voluntary agreements, education and training, awareness raising…

One less common measure is the public service obligation in Flanders requiring the electricity grid operators to achieve each year a given percentage of energy savings on their clients’ consumptions. This measure has now been taken up in the new European directive on energy efficiency.

Another rather innovative measure is the extension to cogeneration of green energy certificates awarded for the production of electricity from renewable energy. The number of certificates awarded is proportional to the estimated CO2 emission reduction.

In the transport sector, public transport has been significantly encouraged by making public transport at low cost or free of charge for certain categories of citizens (people above 65 years of age and civil servants for their home-to-work trips, in the case of railways) or generally (case of various towns).

A new innovative measure is the Employment-Environment Alliance of the Walloon Region (measures BEL28 in the Household sector and BEL27 in the Tertiary sector), which aims at improving the quality and the energy performance of the existing building stock while reorienting the building sector towards a more sustainable approach and reinforcing its employment level.

In Flanders, a reduction in property tax is being awarded since 2009 for new buildings that perform significantly better than the compulsory energy performance standards (measures BEL24 for Households and BEL19 for Tertiary).

The Brussels region is considering making energy audits mandatory for buildings of over 3500 m² not allocated to housing upon renewal of their environmental permits (measure BEL15 in Tertiary).

For the Tertiary sector, Brussels is also considering introducing the obligation to establish a plan for the reduction of energy consumption on major consumers ("PLAGE": Local Action Plan for Energy Management).

5.3 Energy efficiency measure evaluations

5.3.1 Semi-quantitative Impact Estimates of Energy Efficiency Measures

One of the objectives of the MURE database is also to provide information on the impact of the measures. Wherever quantitative impact evaluations are available for particular measures they are taken up in the database. As quantitative impact data are not available for all measures, the database also contains for each measure a qualitative expert judgment of the energy or CO2 saving, under the form of a category (high/medium/low).

The tables on the following pages are intended to present a rough subjective assessment of the impact of each of the MURE measures (see Annex 1 for more information on these MURE measures).

Definition of the qualitative impact level

For each sector (households, transport, industry or tertiary), the impact of a measure is defined according to the percentage of the total final energy consumption of the sector that the energy saving represents. However electricity savings are linked only to the electricity consumption, all other savings (except for those involving fuel substitution and CHP) to the overall final energy consumption of the sector.

For fuel substitution and CHP, the savings are linked to primary energy, calculated with a fixed factor of 2.5.

The categories (low, medium, high) are linked to the aggregate electricity or energy consumption of the respective sector (households, transport, industry or tertiary), and not to a particular end-use, because the aggregation of the impacts is easier.

The following limits (in each case in % of the overall final energy or electricity consumption of the sector; in case of fuel substitution and CHP: of primary energy consumption) are defined as follows for the three impact levels:

- low impact: <0.1%
- medium impact: 0.1-<0.5%
- high impact: ≥0.5%)

5.3.1.1 Households

Code	Title	Semi-quantitative Impact
BEL23	Brussels - Assist households proactively with regard to energy and eco-construction to improve the quality and energy comfort of their residence	High
BEL32	Brussels - Introduce labelling and certification for sustainable buildings	Unknown
BEL33	Brussels - Introduce a minimum energy performace threshold for rental housing (through modification of the Brussels housing code)	Unknown
BEL19	Federal Government - K insulation level buildings regulations	High
BEL15	Minimum efficiency requirements for new central heating boilers	High
BEL16	EU-related: Energy Labelling of Household Appliances (Directive 92/75/EC) - Federal Government - Labels on electrical household appliances	High
BEL13	Federal government - Reduced VAT for renovation of old buildings	Unknown
BEL31	Brussels - Act structurally on the supply by stimulating the sustainable building sector	Unknown
BEL34	Wallonia - Training and information	Unknown

Code	Title	Semi-quantitative Impact
BEL1	Federal government - Tax deduction for energy saving measures in residential buildings	Unknown
BEL10	Brussels - Grant energy subsidies	Medium
BEL30	Wallonia - Financial incentives for RUE investments in buildings	High
BEL29	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Flanders - Insulation and energy performance regulation for buildings	High
BEL35	Wallonia - Public service obligation - gas and electricity invoices	Unknown
BEL22	Federal Government - Foundation for Reducing the Total Cost of Energy in Residential Buildings	Unknown
BEL26	Brussels - Develop and promote exemplary buildings - BATEX (with virtually zero consumption and of high environmental quality)	High
BEL36	Brussels - Develop mechanisms for financial support of sustainable renovation of buildings (green social loan, third party investor, use of the Fund for the Reduction of overall Energy Costs)	Unknown
BEL8	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Wallonia - Thermal regulation for buildings	High
BEL25	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Brussels - Act structurally on the demand through progressive reinforcement of the requirements of the EPB (building energy performance) regulations - Inspection of technical fac...	High
BEL24	Flanders - Reduction in property tax	Low
BEL28	Wallonia - Potential impact of AEE (Employment Environment Alliance)	High

5.3.1.2 Transport

Code	Title	Semi-quantitative Impact
BEL12	Brussels – Measures in the transport sector	Medium
BEL8	Federal Government - Free transport between home and work	Unknown
BEL18	Modulation of the road and circulation taxes	Unknown
BEL9	Modification of the starting circulation tax	Unknown
BEL16	Promotion of car sharing	Low
BEL20	Flanders - Mobility management measures and measures that bring about a shift in the choice of transport	High
BEL5	Promotion of bicycle use	Low
BEL17	Improvement of multimodal systems	Unknown
BEL4	Wallonia - Saving measures for transport in the public sector	Medium
BEL19	Wallonia - Financial incentives or funding devoted to transport	High

5.3.1.3 Industry

Code	Title	Semi-quantitative Impact
BEL24	Energy efficiency information actions for industry	Unknown
BEL9	Federal Government - Tax deduction for energy saving investments in businesses	Low
BEL6	Energy audits	Unknown
BEL22	Flanders - Audit and benchmark agreement	High
BEL4	Energy efficiency criteria in environmental permits	Low
BEL7	Wallonia - Voluntary agreements on energy efficiency or CO2 (ETS)	High
BEL21	Wallonia - Voluntary agreements excluding ETS	High
BEL23	Wallonia - Subsidies for industry investments (excluding buildings)	Low

5.3.1.4 Tertiary

Code	Title	Semi-quantitative Impact
BEL24	Brussels - Introduce labelling and certification for sustainable buildings	Unknown
BEL1	K insulation level buildings regulations	High
BEL5	Minimum efficiency requirements for new central-heating boilers on oil or gas (CE mar	Low
BEL4	EU-related: Energy Labelling Office Equipment (Energy Star) - Energy label for appliances	Low
BEL9	Promotion of RUE with the local authorities	Low
BEL23	Brussels - Act structurally on the supply by stimulating the sustainable building sector	Unknown
BEL25	Wallonia - Training and information	Unknown
BEL13	Flanders - Subsidies for energy saving measures in horticulture (cultivation under glass)	High
BEL17	Wallonia - Subsidies for RUE investments in Public Buildings	High
BEL21	Brussels - Grant energy subsidies	Unknown
BEL18	Wallonia - Public lighting (including EPURE) + traffic lights	High
BEL26	Wallonia - Public service obligation - gas and electricity invoice	Unknown
BEL28	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Flanders - Insulation and energy performance regulations for buildings	High
BEL8	Wallonia - RUE information in public buildings	Unknown
BEL16	Brussels - Develop and promote exemplary buildings - BATEX (with virtually zero consumption and of high environmental quality)	High
BEL22	Brussels - Develop mechanisms for financial support of sustainable renovation of buildings	Unknown
BEL7	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Brussels - Act structurally on the demand through progressive reinforcement of the requirements of the EPB regulations - Inspection of technical facilities - Energy certificate	High
BEL20	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Wallonia - Thermal regulation for buildings	High
BEL19	Flanders - Reduction in property tax	Low
BEL14	Brussels - Impose a plan for reduction of energy consumption on major consumers ("PLAGE": Local Action Plan for Energy Management)	High

Code	Title	Semi-quantitative Impact
BEL15	Brussels - Make performance of an energy audit mandatory for any building of more than 3500 m² not allocated to housing upon renewal of its environmental permit	High
BEL27	Wallonia - Potential impact of AEE (Employment Environment Alliance)	High

5.3.1.5 Cross-cutting

Code	Title	Semi-quantitative Impact
BEL2	Energy Efficiency Policies of the federal Government and the Regions	Unknown
BEL10	General information actions on energy efficiency	Unknown
BEL11	Federal Government - Minimum efficiency requirements for new central-heating boilers on liquid fuels gas with a capacity>400 kW	Unknown
BEL9	Flanders - Promotion of photovoltaïc solar panels via green certificates, preceded by subsidies	High
BEL14	Flanders - Imposing RUE-public service obligations on the electricity distribution grid operators, in combination with a subsidy from the Flemish government for roof insulation	High
BEL4	Wallonia - Green Certificates for renewable electricity and high yield cogeneration	High
BEL6	Wallonia - Subsidies for cogeneration	Medium
BEL7	Wallonia - Subsidies for the cogeneration in the public sector	Medium
BEL8	Flanders - Promotion of qualitative cogeneration via cogeneration certificates	High
BEL12	Promotion of cogeneration	Unknown

5.3.2 Lessons from Quantitative Energy Efficiency Measure Evaluations

Currently, quantitative impact evaluations are available for a large number of policy measures. These evaluations are taken form the Second National Energy Efficiency Action Plan (see section 3.3.3), for which they were mainly prepared by the three re-

gional authorities. The three Regions have worked in consultation in order to harmonise assumptions and methodologies to evaluate policies and measures in the framework of directive 2006/32, taking into account the guidelines provided by the European Commission in the framework of this directive.

The ex-post and ex-ante evaluations have mainly been carried out in a bottom-up approach, i.e. by individual policy measure, and on the basis of the penetration of energy saving technologies.

In Wallonia, a detailed database system has been set up to this end, which among other things is fed with data from various databases dedicated to specific granting schemes and containing information about individual applications.

Table 2 on next page presents the quantitative impacts by measure, in terms of final energy savings, of the measures for which an evaluation is available. The estimated savings amount to 51,80 PJ (14,4 GWh) for 2010 (ex-post evaluation) and to 125 PJ (34,7 GWh) for 2016 (ex-ante evaluation).

Table 2: Quantitative impact by measure (final energy saving)

Code	Sector	Title	Starting Year	Impact 2010 (PJ)	Impact 2016 (PJ)	Comments
BEL23	Household	Brussels - Assist households proactively with regard to energy and eco-construction to improve the quality and energy comfort of their residence			0,44	
BEL30	Household	Wallonia - Financial incentives for RUE investments in buildings	2005	4,72	10,36	
BEL29	Household	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Flanders - Insulation and energy performance regulation for buildings	2006	6,22	13,23	Impact includes that of measure BEL17 of Tertiary sector
BEL26	Household	Brussels - Develop and promote exemplary buildings - BATEX (with virtually zero consumption and of high environmental quality)	2007		0,76	Impact includes that of measure BEL 16 of Tertiary sector
BEL8	Household	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Wallonia - Thermal regulation for buildings	2008	1,19	2,35	Impact includes that of measure BEL 21 of Tertiary sector
BEL25	Household	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Brussels - Act structurally on the demand through progressive reinforcement of the requirements of the EPB (building energy performance) regulations - Inspection of technical fac...	2008		3,82	Impact includes that of measure BEL 7 of Tertiary sector
BEL24	Household	Flanders - Reduction in property tax	2009	0,09	0,29	Impact includes that of measure BEL19 of Tertiary sector
BEL28	Household	Wallonia - Potential impact of AEE (Employment Environment Alliance)	2012		2,18	Impact includes that of measure BEL27 of Tertiary sector
BEL13	Tertiary	Flanders - Subsidies for energy saving measures in horticulture (cultivation under glass)	2001	2,94	7,53	

Code	Sector	Title	Starting Year	Impact 2010 (PJ)	Impact 2016 (PJ)	Comments
BEL17	Tertiary	Wallonia - Subsidies for RUE investments in Public Buildings	2004	0,58	1,37	
BEL18	Tertiary	Wallonia - Public lighting (including EPURE) + trafficlights	2005	0,70	0,70	
BEL20	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Flanders - Insulation and energy performance regulations for buildings	2006			Impact included in that of measure BEL26 of Household sector
BEL16	Tertiary	Brussels - Develop and promote exemplary buildings - BATEX (with virtually zero consumption and of high environmental quality)	2007			Impact included in that of measure BEL26 of the Household sector
BEL7	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Brussels - Act structurally on the demand through progressive reinforcement of the requirements of the EPB regulations - Inspection of technical facilities - Energy certificate	2008			Impact included in that of measure BEL25 of the Household sector
BEL20	Tertiary	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Wallonia - Thermal regulation for buildings	2008			Impact included in that of measure BEL8 of the Household sector
BEL19	Tertiary	Flanders - Reduction in property tax	2009			Impact included in that of measure BEL24 of the Household sector
BEL14	Tertiary	Brussels - Impose a plan for reduction of energy consumption on major consumers ("PLAGE": Local Action Plan for Energy Management)	2012		1,10	
BEL15	Tertiary	Brussels - Make performance of an energy audit mandatory for any building of more than 3500 m² not allocated to housing upon renewal of its environmental permit	2012		1,03	
BEL27	Tertiary	Wallonia - Potential impact of AEE (Employment Environment Alliance)	2012			Impact included in that of measure BEL28 of the Household sector
BEL22	Industry	Flanders - Audit and benchmark agreement	2003	4,50	6,34	

Code	Sector	Title	Starting Year	Impact 2010 (PJ)	Impact 2016 (PJ)	Comments
BEL21	Industry	Wallonia - Voluntary agreements excluding ETS	2004	2,84	2,84	
BEL23	Industry	Wallonia - Subsidies for industry investments (excluding buildings)	2005	0,05	0,08	
BEL12	Transport	Brussels – Measures in the transport sector	2004		1,17	
BEL20	Transport	Flanders - Mobility management measures and measures that bring about a shift in the choice of transport	2003	2,30	18,04	
BEL4	Transport	Wallonia - Saving measures for transport in the public sector	2008	0,90	0,52	
BEL19	Transport	Wallonia - Financial incentives or funding devoted to transport	2008	0,84	2,32	
BEL9	General cross-cutting	Flanders - Promotion of photovoltaïc solar panels via green certificates, preceded by subsidies	1998	1,71	2,06	
BEL14	General cross-cutting	Flanders - Imposing RUE-public service obligations on the electricity distribution grid operators, in combination with a subsidy from the Flemish government for roof insulation	2003	18,13	37,80	
BEL4	General cross-cutting	Wallonia - Green Certificates for renewable electricity and high yield cogeneration	2004	0,40	2,32	
BEL6	General cross-cutting	Wallonia - Subsidies for cogeneration	2004	0,52	0,97	
BEL7	General cross-cutting	Wallonia - Subsidies for the cogeneration in the public sector	2005	0,14	0,30	
BEL8	General cross-cutting	Flanders - Promotion of qualitative cogeneration via cogeneration certificates	2005	3,07	5,07	
TOTAL				51,80	124,97	

6 National Developments under the EU Energy Efficiency Directive and the 20% Energy Efficiency Target of the EU

The policies pursued in the framework of the Energy Efficiency directive are described in the Second National Energy Efficiency Action Plan (NEEAP) in the framework of EU directive 2006/32, which was submitted to the European Commission in 2011 (NEEAPs translated in English). As already mentioned, this plan compiles and comprises as annexes the individual plans of the federal government and of each of the three Regions (Flanders, Wallonia and Brussels-Capital). It describes and provides impact evaluations for the energy efficiency policy measures taken by the relevant federal or regional authorities.

As mentioned in section 3.3, rational use of energy falls within the competence of the Regions. The Federal State also implements some measures aimed at enhancing energy efficiency within its competences (taxation, product standards…).

The federal structure and the distribution of competences in the field of energy have made it necessary to organise a consultation between the Regions and the Federal State. As regards European and international matters, such consultation takes place within the « Inter-ministerial Conference for Economy and Energy », which set up the working group CONCERE/ENOVER (Consultation between the Federal State and the Regions on energy matters) in 1991 through a cooperation agreement. This working group holds regular meetings and has set up various specific working groups, among which one on energy efficiency.

The indicative energy savings targets for 2016 and the intermediate target for 2010 were defined at the regional level according to a common method and on the basis of the regional energy balance sheets. Each Region has committed itself to reaching a 9% energy savings target. The measures implemented by the Federal State are meant as supporting or additional measures.

The national energy savings target and the national intermediate target respectively amount to the sum of the regional targets and the sum of the intermediate regional targets. This is how Belgium meets its obligations as a Member State. Each Region aims to reach the calculated energy savings target and to this end, draws up its own regional action plan. Each Region is also responsible for monitoring the implementation of its own measures. The Federal State has also listed its measures in a federal action plan. However, these measures were not evaluated separately from the regional measures, as they overlap with the regional measures to a certain extent.

The ex-ante evaluation of the energy savings for 2016 of the second NEEAP shows that Brussels would reach its energy savings target and that Flanders exceed it by about 50%. For Wallonia, 87% of the target would be reached with the policies and measures that have been evaluated; however, this figure is an underestimate, because for this region the impact of new voluntary agreements, currently under negotiation, has not been taken into account and the impact of the EPB[16] directive is underestimated (new apartment blocks, tertiary buildings and renovation have not been quantified).

The 2nd NEEAP does not yet define energy saving targets for 2020. Such targets are currently still in preparation.

[16] Energy Performance of Buidings.

7 ANNEXES

Annex 1: Energy Efficiency Measure Summary

Households

Code	Title	Status	Type	Starting Year	Semi-quantitative Impact	NEEAP Measure
BEL23	Brussels - Assist households proactively with regard to energy and eco-construction to improve the quality and energy comfort of their residence	Ongoing	Information/Education		High	Yes
BEL32	Brussels - Introduce labelling and certification for sustainable buildings	Proposed (advanced)	Information/Education		Unknown	Yes
BEL33	Brussels - Introduce a minimum energy performace threshold for rental housing (through modification of the Brussels housing code)	Proposed (advanced)	Unknown		Unknown	Yes
BEL19	Federal Government - K insulation level buildings regulations	Ongoing	Legislative/Normative	1985	High	No
BEL15	Minimum efficiency requirements for new central heating boilers	Ongoing	Legislative/Informative, Legislative/Normative	1998	High	No
BEL16	EU-related: Energy Labelling of Household Appliances (Directive 92/75/EC) - Federal Government - Labels on electrical household appliances	Ongoing	Legislative/Informative	1998	High	Yes
BEL13	Federal government - Reduced VAT for renovation of old buildings	Ongoing	Fiscal/Tariffs	2000	Unknown	No
BEL31	Brussels - Act structurally on the supply by stimulating the sustainable building sector	Ongoing	Information/Education	2000	Unknown	Yes
BEL34	Wallonia - Training and information	Ongoing	Information/Education	2002	Unknown	Yes
BEL1	Federal government - Tax deduction for energy saving measures in residential buildings	Ongoing	Fiscal/Tariffs	2003	Unknown	Yes
BEL10	Brussels - Grant energy subsidies	Ongoing	Financial	2003	Medium	Yes

Code	Title	Status	Type	Starting Year	Semi-quantitative Impact	NEEAP Measure
BEL30	Wallonia - Financial incentives for RUE investments in buildings	Ongoing	Financial	2005	High	Yes
BEL29	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Flanders - Insulation and energy performance regulation for buildings	Ongoing	Legislative/Informative, Legislative/Normative	2006	High	Yes
BEL35	Wallonia - Public service obligation - gas and electricity invoices	Ongoing	Unknown	2006	Unknown	Yes
BEL22	Federal Government - Foundation for Reducing the Total Cost of Energy in Residential Buildings	Ongoing	Financial	2007	Unknown	Yes
BEL26	Brussels - Develop and promote exemplary buildings - BATEX (with virtually zero consumption and of high environmental quality)	Ongoing	Financial	2007	High	Yes
BEL36	Brussels - Develop mechanisms for financial support of sustainable renovation of buildings (green social loan, third party investor, use of the Fund for the Reduction of overall Energy Costs)	Ongoing	Financial	2007	Unknown	Yes
BEL8	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Wallonia - Thermal regulation for buildings	Ongoing	Legislative/Normative	2008	High	Yes
BEL25	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Brussels - Act structurally on the demand through progressive reinforcement of the requirements of the EPB (building energy performance) regulations - Inspection of technical fac...	Ongoing	Legislative/Informative, Legislative/Normative	2008	High	Yes
BEL24	Flanders - Reduction in property tax	Ongoing	Fiscal/Tariffs	2009	Low	Yes
BEL28	Wallonia - Potential impact of AEE (Employment Environment Alliance)	Ongoing		2012	High	Yes

Transport

Code	Title	Status	Type	Starting Year	Semi-quantitative Impact	NEEAP Measure
BEL12	Brussels – Measures in the transport sector	Ongoing	Financial, Infrastructure, Legislative/Informative, SocialPlanning/Organisational	2004	Medium	Yes
BEL8	Federal Government - Free transport between home and work	Ongoing	Fiscal	2001	Unknown	Yes
BEL18	Modulation of the road and circulation taxes	Ongoing	Fiscal	2001	Unknown	No
BEL9	Modification of the starting circulation tax	Completed	Fiscal	2002	Unknown	No
BEL16	Promotion of car sharing	Ongoing	SocialPlanning/Organisational	2003	Low	No
BEL20	Flanders - Mobility management measures and measures that bring about a shift in the choice of transport	Ongoing		2003	High	Yes
BEL5	Promotion of bicycle use	Ongoing	Information/Education/Training	2004	Low	No
BEL17	Improvement of multimodal systems	Ongoing	Infrastructure	2005	Unknown	No
BEL4	Wallonia - Saving measures for transport in the public sector	Ongoing	Infrastructure	2008	Medium	Yes
BEL19	Wallonia - Financial incentives or funding devoted to transport	Ongoing	Co-operative Measures , Financial, Fiscal, Infrastructure	2008	High	Yes

Industry

Code	Title	Status	Type	Starting Year	Semi-quantitative Impact	NEEAP Measure
BEL24	Energy efficiency information actions for industry	Ongoing	Information/Education/Training		Unknown	Yes
BEL9	Federal Government - Tax deduction for energy saving investments in businesses	Ongoing	Fiscal/Tariffs	1993	Low	Yes
BEL6	Energy audits	Ongoing	Financial	2002	Unknown	No
BEL22	Flanders - Audit and benchmark agreement	Ongoing	Co-operative Measures	2003	High	Yes
BEL4	Energy efficiency criteria in environmental permits	Ongoing	Legislative/Informative	2004	Low	No
BEL7	Wallonia - Voluntary agreements on energy efficiency or CO2 (ETS)	Ongoing	Co-operative Measures	2004	High	No
BEL21	Wallonia - Voluntary agreements excluding ETS	Ongoing	Co-operative Measures	2004	High	Yes
BEL23	Wallonia - Subsidies for industry investments (excluding buildings)	Ongoing	Financial	2005	Low	Yes

Tertiary

Code	Title	Status	Type	Starting Year	Semi-quantitative Impact	NEEAP Measure
BEL24	Brussels - Introduce labelling and certification for sustainable buildings	Proposed (medium/long-term)	Information/Education/Training		Unknown	Yes
BEL1	K insulation level buildings regulations	Ongoing	Legislative/Normative	1986	High	No
BEL5	Minimum efficiency requirements for new central-heating boilers on oil or gas (CE mar	Ongoing	Legislative/Normative	1997	Low	No
BEL4	EU-related: Energy Labelling Office Equipment (Energy Star) - Energy label for appliances	Ongoing	Information/Education/Training	1999	Low	No
BEL9	Promotion of RUE with the local authorities	Ongoing	Financial	1999	Low	No
BEL23	Brussels - Act structurally on the supply by stimulating the sustainable building sector	Ongoing	Information/Education/Training	2000	Unknown	Yes
BEL25	Wallonia - Training and information	Ongoing	Information/Education/Training	2000	Unknown	Yes
BEL13	Flanders - Subsidies for energy saving measures in horticulture (cultivation under glass)	Ongoing	Financial	2001	High	Yes
BEL17	Wallonia - Subsidies for RUE investments in Public Buildings	Ongoing	Financial	2004	High	Yes
BEL21	Brussels - Grant energy subsidies	Ongoing	Financial	2004	Unknown	Yes
BEL18	Wallonia - Public lighting (including EPURE) + trafficlights	Ongoing	Financial	2005	High	Yes
BEL26	Wallonia - Public service obligation - gas and electricity invoice	Ongoing	Information/Education/Training	2006	Unknown	Yes
BEL28	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Flanders - Insulation and energy performance regulations for buildings	Ongoing	Legislative/Informative, Legislative/Normative	2006	High	Yes

Code	Title	Status	Type	Starting Year	Semi-quantitative Impact	NEEAP Measure
BEL8	Wallonia - RUE information in public buildings	Ongoing	Financial, Information/Education/Training	2007	Unknown	Yes
BEL16	Brussels - Develop and promote exemplary buildings - BATEX (with virtually zero consumption and of high environmental quality)	Ongoing	Financial, Information/Education/Training	2007	High	Yes
BEL22	Brussels - Develop mechanisms for financial support of sustainable renovation of buildings	Ongoing	Financial	2007	Unknown	Yes
BEL7	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Brussels - Act structurally on the demand through progressive reinforcement of the requirements of the EPB regulations - Inspection of technical facilities - Energy certificate	Ongoing	Legislative/Informative, Legislative/Normative	2008	High	Yes
BEL20	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Wallonia - Thermal regulation for buildings	Ongoing	Legislative/Informative, Legislative/Normative	2008	High	Yes
BEL19	Flanders - Reduction in property tax	Ongoing	Fiscal/Tariffs	2009	Low	Yes
BEL14	Brussels - Impose a plan for reduction of energy consumption on major consumers ("PLAGE": Local Action Plan for Energy Management)	Proposed(advanced)	Legislative/Informative	2012	High	Yes
BEL15	Brussels - Make performance of an energy audit mandatory for any building of more than 3500 m² not allocated to housing upon renewal of its environmental permit	Unknown	Legislative/Informative	2012	High	Yes
BEL27	Wallonia - Potential impact of AEE (Employment Environment Alliance)	Unknown		2012	High	Yes

Cross-cutting

Code	Title	Status	Type	Starting Year	Semi-quantitative Impact	NEEAP Measure
BEL2	Energy Efficiency Policies of the federal Government and the Regions	Ongoing	General Energy Efficiency / Climate Change / Renewable Programmes		Unknown	No
BEL10	General information actions on energy efficiency	Ongoing			Unknown	No
BEL11	Federal Government - Minimum efficiency requirements for new central-heating boilers on liquid fuels gas with a capacity>400 kW	Ongoing	Non-classified Measure Types	1997	Unknown	No
BEL9	Flanders - Promotion of photovoltaïc solar panels via green certificates, preceded by subsidies	Ongoing	Financial Measures, Legislative/Normative Measures, Market-based Instruments	1998	High	Yes
BEL14	Flanders - Imposing RUE-public service obligations on the electricity distribution grid operators, in combination with a subsidy from the Flemish government for roof insulation	Ongoing	Financial Measures, Legislative/Normative Measures	2003	High	Yes
BEL4	Wallonia - Green Certificates for renewable electricity and high yield cogeneration	Ongoing	Market-based Instruments	2004	High	Yes
BEL6	Wallonia - Subsidies for cogeneration	Ongoing	Financial Measures	2004	Medium	Yes
BEL7	Wallonia - Subsidies for the cogeneration in the public sector	Ongoing	Financial Measures	2005	Medium	Yes
BEL8	Flanders - Promotion of qualitative cogeneration via cogeneration certificates	Ongoing	Legislative/Normative Measures, Market-based Instruments	2005	High	Yes
BEL12	Promotion of cogeneration	Ongoing	Non-classified Measure Types	2005	Unknown	No

Annex 2: Country Profile

Energy Efficiency Profile : Belgium

October 2008

Energy Efficiency Trends

Overview

Over the period 2000-2006 the energy efficiency bottom-up index for the total final energy consumption (ODEX) decreased by 7 %. Mainly the industrial sector contributed to this development, whereas the energy efficiency index of the transport sector only scarcely im-proved (6%) and the index of households is almost stable (-2%).

It should be noted that this index remains quite approximate, because of limitations in available statistical data, in particular a lack of disaggregation in the national energy consumptions.

Industry

In 2006, the efficiency index for the industrial sector (measured at the level of 9 branches - in terms of energy used per production index or per tonne - and aggregated to the whole sector) had improved by 12% compared to the base year 2000 (19% in relation to 1990). In general all sectors show significant energy savings. Consumption data (which have been compiled from regional statistics) are missing for 1991-1993. Noteworthy is the substantial increase in the ODEX of the chemical industry between 1990 and 1994, which reveals a major structural effect in this sector (investment in naphtha cracking), without which the efficiency improvement would have been higher.

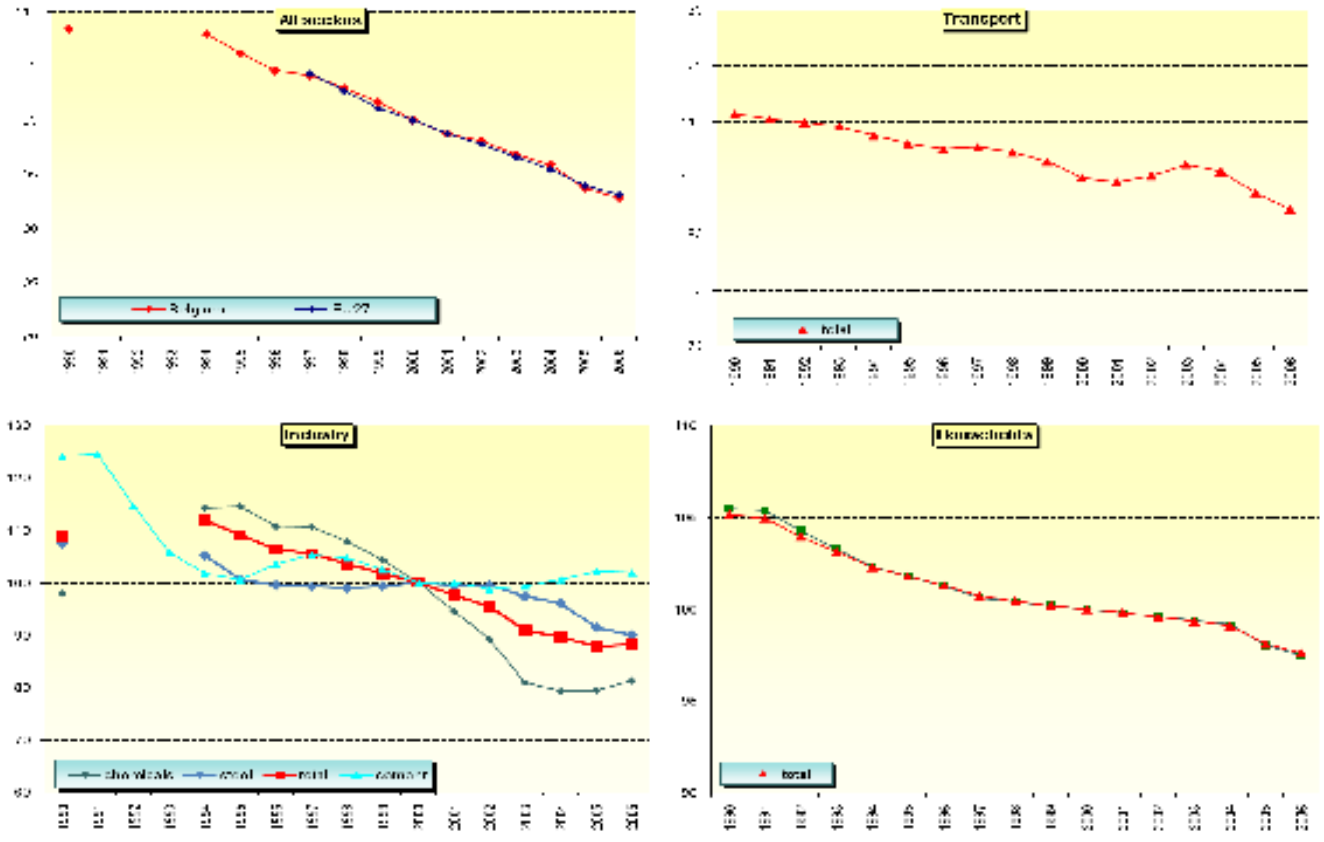
Households

For the households sector, the energy efficiency index takes into account space heating, water heating and cooking. It's measured by the average fuel consumption per use and dwelling. For space heating, it includes climatic correction and correction for the penetration of central heating. Between 2000 and 2006, the index has declined by only 2%. Since 1990, the decrease is 7%.

Transport

For the transport sector, the index takes into account road, rail and air transport. For road transport, given the lack of data on the vehicle fleet's average specific consumptions, this index represents the evolution of the energy consumption per vehicle, and is thus influenced as well by the average vehicle mileage as by the efficiency of the vehicles. Between 1990 and 2000, the index has declined by 11%. Since 2000 and despite a light increase in 2002/2003, it decreased by 6% more (mostly because of the index of road transport improved).

Energy efficiency index , base 100 = 2000



Source: ODYSSEE data base

Energy Efficiency Policy Measures

Institutions and programmes

Belgium is a federal country and energy efficiency as well as the development of renewable energy sources are essentially a responsibility of the 3 regions (Flanders, Wallonia, Brussels). The *National Climate Plan 2002-2012*, which has been signed in 2002 by both the federal and the regional ministers responsible for environment, energy and transport, foresees a number of measures to be taken at either the federal or the regional levels. A new National Climate Plan is currently under preparation. Each region has also developed its own, multi-annual, climate plan.
The Flemish Region has issued its second climate plan (Vlaams Klimaatsbeleidsplan 2006-2012) in 2006; in Wallonia climate plan (Plan Air-Climat) was modified and adopted in March 2007.

Industry

For industry, the energy efficiency policy is focussed on voluntary agreements between industry and the (regional) government. In Flanders, these agreements are "benchmark" agreements, with a commitment to bring the energy efficiency to the world top ten by 2012. They are signed by individual companies with an energy consumption larger than 0.5 PJ per year. By December 2006, 185 companies had signed such an agreement. In Wallonia, voluntary agreements have been signed by 13 sector associations representing more than 120 companies, which commit themselves to a quantified energy efficiency improvement for the sector over the period 2000-2012. Besides, cogeneration is actively promoted in all three Regions, through a range of instruments (subsidies, fiscal deductions, green certificates, information campaigns...).

Households, Services

All three regions enforce thermal insulation standards for new and renovated buildings in the household and the tertiary sectors. They have transposed European directive 2002/91 on the energy performance of buildings, imposing energy performance standards for all types of buildings, taking into account all energy efficiency aspects (building shell, heating, ventilation...) for new and existing buildings. In the Flemish Region, the EPB entered in force in January 2006; in Brussels, since July 2008 and it's foreseen in Wallonia from September 2009.
All three Regions award subsidies for a range of energy saving or renewable energy investments, as well as for energy audits or energy accounting schemes.
At the federal level, the purchase of energy saving equipment is being encouraged by fiscal deductions for energy saving investments, as well as by labelling of large domestic appliances.
In Flanders, quantified energy savings (between 1% and 2.2% per year in 2003-2008) for their customers are being imposed to electricity grid operators as a public service obligation. The latter award premiums to their clients for the purchase of energy saving appliances, which are financed through an increase in electricity prices.

Transport

Emphasis is put on the promotion of public transport, by extending its supply and improving its availability, its quality and its price attractiveness. Free access to public transport is also provided, either to certain categories of citizens (people above 65 years of age and civil servants for their home-to-work trips, in the case of railways). A particular effort has also been put on promoting the development of mobility planning tools such as company transport plans, urban mobility plans, school transport plans.

Energy prices and taxes

In the voluntary agreements, the public authorities have promised, if it is in their power, that no CO2 tax would be applied to the participating companies. However such a tax is not under discussion. For stationary applications, there are some federal energy taxes on fuels and electricity, which have been adapted in 2003 (increase for liquid petroleum products, decrease for natural gas for households). A progressive shift from the diesel car purchase tax towards the diesel excise tax has also been implemented. The changes remain in the order of a few percent of the fuel prices.

Selected Energy Efficiency Measures

Sectors	Title of Measure	Since
Industry	Voluntary agreements on energy efficiency or CO2	2000
Industry	Promotion of cogeneration	
Households	Insulation standards for new dwellings	1985
Households	Insulation standards for renovated dwellings	2000
Households	Energy label for appliances	
Households and tertiary	Labels for high efficiency boilers (OPTIMAZ, HR, HR+)	1985
Households and tertiary	Public service obligation of electricity grid managers in Flanders	2003
Households and tertiary	Energy performance standards of buildings (in the 3 regions)	2006, 2008,2009
Tertiary	Insulation standards for new and renovated buildings	2000
Transport	Promotion of public transport	

Source: MURE data base
www.mure2.com

Annex 3: Data Situation and Data Quality

Limited availability of data

There is no centralisation of statistical data on determinants of energy consumption in Belgium. Therefore, as usual, the data necessary for completing the ODYSSEE data base have been collected specifically for this project from a large number of different sources.

Most available data have been updated to the year 2010.

Despite the large amount of data that has been collected, a data shortage remains. In particular, the following data are still unavailable:

- the disaggregation of fuel consumption in the residential sector between space heating, water heating and other uses; we have used here a disaggregation proposed by ENERDATA, coordinator of the project;
- a disaggregation of energy consumptions by sub-sector in the tertiary sector (hospitals, schools, public administration,...), which would allow an analysis of structural effects in that sector;
- the consumption of electricity in the residential and tertiary sector (only the high voltage fraction of the consumption is known); we have used the data of the regional energy balances;
- the disaggregation of fuel consumption for road transport by type of transport (passenger/goods) and by type of vehicle (e.g. passenger cars versus trucks);
- aside from a few exceptions, unit consumption data by main intensive product (eg, chlorine, ammonia, olefines) and its evolution in time; note that this generally the case in the other countries too;
- evolution of energy consumptions by type of process (eg, electric steel, cement production by the wet or dry route).

Quality of the data

The indicators presented in this report are of course a function of the quality of the data used, i.e. in particular the activity and energy consumption data. It is therefore im-

portant to keep in mind the limits in the data when drawing conclusions from these indicators.

In this respect, comments are given below on the quality of national accounting statistics (value added and GDP) and energy consumption data, and a table is provided which assesses the quality of the data for the ODEX indicator.

National accounting statistics

The value added data have been updated up to the year 2010. The data source is the national accounts, which are prepared by the Institute of National Accounts, according to reference methodology ESA95.

As mentioned in previous reports, the introduction of ESA95 has triggered an in-depth revision of the way in which the Belgian national accounts are calculated, with fundamental changes to data sources, calculation methods and methodology. The sectoral disaggregation has also been modified to a certain extent. Consistent time series are still only available for the years since 1995.

Since the previous report, published in 2009, the GDP and value added statistics by branch of the National Bank have been significantly revised, which has in turn led to new values for the evolution of energy intensities.

Energy consumption data

By industrial branch, the quality of the official statistics from the Federal Public Service Economy (which are those provided to Eurostat and the International Energy Agency) has some limitations:

- One weakness is the relatively limited quality of the sectoral disaggregation for petroleum products, and, hence also for the total energy consumption by sector (in particular industrial branches).

  This is due to the fact that these energy consumption statistics are based on information from energy suppliers. While for grid bound energy carriers such as natural gas and electricity, the sectoral allocation is generally well known, the dealers of petroleum products are not always aware of the sector where the products they supply are being used, in particular because of the presence of intermediary wholesalers.

- For the year 2002, there is an important anomaly in the energy consumption of the iron & steel sector, which decreased by 19% in comparison with 2001, while the steel production rose by 5%. More precisely, the consumption of solid fuels declined by 35%, while the proportions of oxygen and electric steel had practically remained stable.
- For the years 2003 and 2004, the energy consumption statistics of several industrial branches seem overestimated because of a sudden upward jump of their natural gas consumption, for which we could get no explanation. This is essentially the case for the non-metallic minerals, food, textile and metal construction sectors. The total gas consumption of industry for these years does not look abnormal. The problem rather lies in the distribution of this consumption among the various branches. One possible reason might be a (partial) distribution of the consumption of the "Other sectors", without retroactive effect on the previous consumptions.
- The federal energy consumption statistics don't include important waste fuels, such as those used in the petrochemical industry, the cement industry and the pulp & paper industry. For these three sectors the sum of the regional energy consumption statistics, which do include waste fuels, are significantly larger than the federal figures. From a point of view of energy efficiency monitoring, it is important to take all energy carriers into account.
- A further limit of the federal statistics is that they are actually supply statistics rather than consumption statistics, and may differ from the latter because of stock variations.

For these reasons, instead of using the federal statistics' figures, we have aggregated the energy consumption statistics of the three Regions. This aggregation remains a rough approach, as the regional statistics are not harmonised (there may remain differences in sector allocation, fuel definitions, treatment of autoproducers, the accounting or stocks…), but has been considered preferable to keeping the federal statistics.

ODEX data quality

The quality of the ODEX indicators is qualified by qualifying the data used for calculating the indicator. Two types of grades are used:

- one to qualify the data source A, B and C;
- one to qualify the data quality 1,2 and 3.

The grades were given using “objective” criteria for the source and semi-objective criteria for the quality.

Quality of source:

A: Official statistics

Official statistics/surveys (national statistical office, Eurostat/AIE, Ministries statistics); Model estimations used as official statistics; Data “stamped” by Ministries

B: Surveys/ modelling estimates (consulting, research centres, universities, industrial associations)

C: Estimations made by national teams (for the project)

Quality of data:

1 Good

2 Medium

3 Poor

The tables below show the qualification of the data used for the various indicators.

	Unit	Quality	Grade
INDUSTRIE			
Consumption			
chemicals, rubber & plastics	Mtoe	A	1
primary metals	Mtoe	A	1
steel	Mtoe	A	1
other (non ferrous)	Mtoe	A	1
non mineral netallic	Mtoe	A	1
cement	Mtoe	A	1
other	Mtoe	A	1
paper	Mtoe	A	1
food	Mtoe	A	1
textiles	Mtoe	A	1
equipment	Mtoe	A	1
Production index			
chemicals, rubber & plastics	index	A	1
non ferrous	index	A	1
non mineral netallic	index	A	1
food	index	A	1
textiles	index	A	1
equipment	index	A	1
Production			
production of steel	kt	A	1
production of paper	kt	A	1
production of cement	kt	A	1
TRANSPORT			
Consumption			
road	Mtoe	A	1
cars	Mtoe		
goods transport	Mtoe		
buses	Mtoe		
motocycles	Mtoe		
rail transport	Mtoe	A	1
water transport	Mtoe	A	3
air (total)	Mtoe	A	1
Data on trafic, specific consumption, stock			
specific cons of cars	l/100km		
trafic of road	Gtkm	A	1
num of bus	k	A	1
number of mototcycles	M	A	1
trafic of water	Gtkm	A	1
number of air transport passengers	Mpas	A	1
rail trafic	Gtkb	A	1
rail trafic of goods	Gtkm	A	1
rail trafic of passengers	Gpkm	A	1
Trains' technical coefficients for goods		A	1
Trains' technical coefficients for passenger		A	1
stock of cars	M	A	1
stock of truck&light veh	M	A	1

	Unit	Quality	Grade
HOUSEHOLDS			
Consumption			
consumption of households	Mtoe	A	1
electricity cons of households	Mtoe	A	1
fuel cons of households	Mtoe	A	1
fuel cons of households with cc	Mtoe	B	2
degree days	1	A	1
degree days of reference	1	A	1
share of space heating	1	C	2
percent of dwelling with central heating	1	A	2
floor area	m2		
Stock of permanently occupied dwellings	k	A	1
Annual new dwellings	k	A	1
number of new houses	k	A	1
Theorical unit consumption of new multi family dwellings	toe/dw	C	3
Theorical unit consumption of new single family dwellings	toe/dw	C	3
specific consumption of new dwellings	toe/dw	C	3

One can notice that overall the data used is of either good or medium quality. This is amongst other thanks to the use of the regional energy consumption statistics.

It should be remembered however that the main limit of the current ODEX indicator for Belgium is not so much the quality of the data used, but the lack of dome data, which obliges us to use a simplified indicator, based on the available data.

Annex 4: Evaluation of the structural effect

The reduction in energy intensity — whether of the GDP as a whole or of a subset of the economy — over a given time period can be decomposed into two separate contributions:

- a ***structural effect***, corresponding to a shift from energy intensive sectors to less en-ergy intensive ones, or vice-versa;

- an ***unit consumption effect*** (which, assuming there are no intra-sectoral structural effects, represents the result of the efficiency improvement).

Calculated mathematically, these two components are not additive, there remains a residue. However, it is convenient and common practice to define these two effects in such a way that they are additive and sum up to the reduction in energy intensity:

Variation in energy intensity = structural effect + unit consumption effect

In order to make them additive, one aggregates the residue with one of the two terms. This can be done by calculating one of the effects in the proper way and deriving the second term by difference.

The energy intensity at year t can be written as:

$$EI_t = \frac{\sum_i VA_{i,t} \frac{CONS_{i,t}}{VA_{i,t}}}{GDP_t}$$

where:

$CONS_{i,t}$: energy consumption of sector i at year t

$VA_{i,t}$: value added of sector i at year t

Note that in this expression, $\frac{CONS_{i,t}}{VA_{i,t}}$ represents the energy intensity of sector i.

Structural effect

The structural effect used in this report is defined as the change in energy intensity between year 0 and year t when the unit consumptions are assumed to remain constant at their value for the reference year.

$$SE_t = EI_0 - \frac{\sum_i VA_{i,t} \frac{CONS_{i,0}}{VA_{i,0}}}{GDP_t}$$

$$= \frac{\sum_i VA_{i,0} \frac{CONS_{i,0}}{VA_{i,0}}}{GDP_0} - \frac{\sum_i VA_{i,t} \frac{CONS_{i,0}}{VA_{i,0}}}{GDP_t}$$

$$= \sum_i \frac{CONS_{i,0}}{VA_{i,0}} \left(\frac{VA_{i,0}}{GDP_0} - \frac{VA_{i,t}}{GDP_t} \right)$$

Unit consumption effect

The unit consumption effect is evaluated as the difference between the total reduction in energy intensity and the structural effect:

Unit consumption effect = $EI_t - EI_0 - SE_t$

$$= \frac{\sum_i VA_{i,t} \frac{CONS_{i,0}}{VA_{i,0}}}{GDP_t} - \frac{\sum_i VA_{i,t} \frac{CONS_{i,t}}{VA_{i,t}}}{GDP_t}$$

$$= \sum_i \frac{VA_{i,t}}{GDP_t} \left(\frac{CONS_{i,0}}{VA_{i,0}} - \frac{CONS_{i,t}}{VA_{i,t}} \right)$$

The unit consumption effect appears as a weighted average of the reduction of energy intensity of the individual sectors, the weighting factors corresponding this time to the structure of the economy in the year for which the efficiency improvement is evaluated.