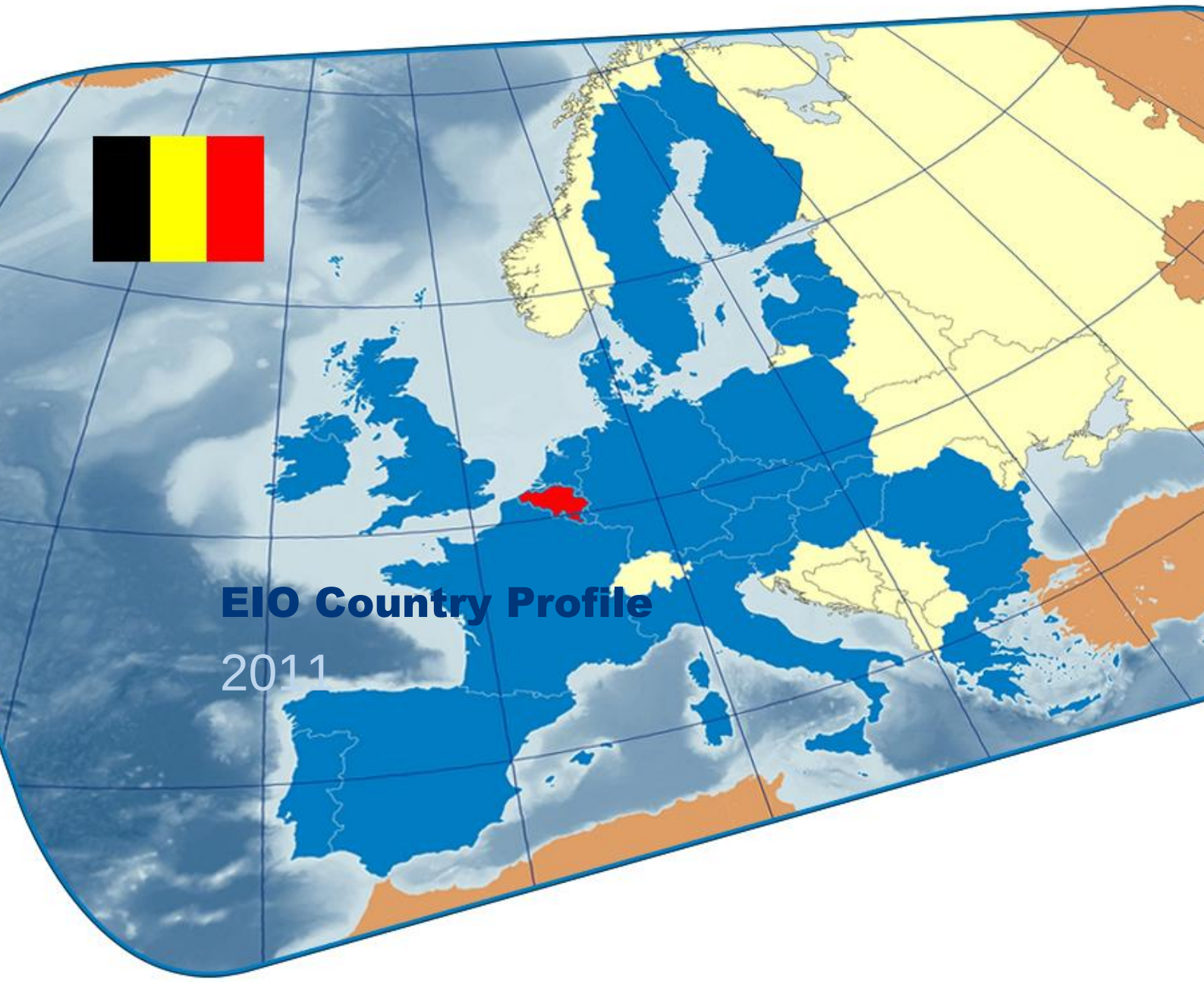
eco-innovation observatory

Eco-innovation in Belgium



EIO Country Profile

2011

European Commission

Eco-Innovation Observatory

The Eco-Innovation Observatory functions as a platform for the structured collection and analysis of an extensive range of eco-innovation information, gathered from across the European Union and key economic regions around the globe, providing a much-needed integrated information source on eco-innovation for companies and innovation service providers, as well as providing a solid decision-making basis for policy development.

The Observatory approaches eco-innovation as a persuasive phenomenon present in all economic sectors and therefore relevant for all types of innovation, defining eco-innovation as:

“Eco-innovation is any innovation that reduces the use of natural resources and decreases the release of harmful substances across the whole life-cycle”.

To find out more, visit **www.eco-innovation.eu**

Eco-Innovation Observatory

Country Profile 2011: Belgium

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This brief is available for downloaded from www.eco-innovation.eu/Belgium

Table of contents

Summary **4**
1 | Introduction **5**
2 | Eco-innovation performance **6**
3 | Established eco-innovation areas and markets **10**
4 | New trends and emerging eco-innovation markets **18**
5 | Public policy in support of eco-innovation **23**
6 | Main findings **28**
6.1 Strengths and weaknesses of Belgium in promotion of eco-innovations *28*
6.2 Opportunities and threats to eco-innovation in Belgium *29*
References **30**
Annex 1. Policy measures addressing eco-innovations in Belgium **32**

Summary

Eco-innovation needs and challenges in Belgium are associated with its poor state of the environment (as a result of intensive agricultural and industrial activities), energy inefficient buildings stock, growing prices for natural resources, expected phasing out of the nuclear energy system, intensified industrialisation and urbanisation and climate change.

The 2011 Eco-innovation Scoreboard places Belgium ninth in the EU27 ranking of eco-innovative countries. It is positioned particularly well in the eco-innovation inputs (due to its strong performance for cleantech investments and human capital) and socio-economic outcomes (due to high performance of eco-industries in exports, employment and turnover).

The country's leading eco-innovation areas are energy efficiency, sustainable construction, sustainable water management and urban greening. These areas have retained their leading position since the previous year, with a stronger focus on sustainable cities and neighbourhoods. The initiatives on sustainable mobility have achieved prominent results in 2011 and can be considered as one of the established leading eco-innovation areas in Belgium. Attempts to change people's mobility patterns are promoted with the new mobility concepts as "cycling instead of driving", as well as with revisiting the ownership concept with "renting a car instead of owning one" (car sharing schemes). These and similar ideas can potentially have an important contribution to more sustainable lifestyles in future by changing the habits and attitudes of people.

Newly emerging eco-innovation areas include biodegradable materials, products based on biosynthesis, and hydrogen energy. Another eco-innovation area presented in this document is nanotechnology. More systemic innovations promoting sustainable urban lifestyle have been initiated to improve the ecological situation and community health in densely populated and intensively constructed cities.

In 2011, there have been certain policy developments on the regional level. In the Walloon region, under the Marshall Plan 2.Green, the regional government has dedicated the sixth Competitiveness Cluster to new environmental technologies. The Flanders region has advanced towards incorporation of the systemic transition concepts and Sustainable Materials Management Programme. The Brussels Capital region in 2011 continued its measures in Brussels with an aim to make the city become a role model in sustainable development and promoting initiatives in eco-buildings, energy, water, waste and green public procurement.

There is a set of supply and demand side policy measures that can directly or indirectly support eco-innovations; those are mostly implemented by the regional governments, while the Federal government is responsible for promoting a number of national action plans and market translation of regional objectives.

1 | Introduction

Eco-innovation needs and challenges in Belgium are associated with a number of economic and environmental problems. With few natural resources, Belgium depends on substantial imports of raw materials and exports of large volumes of manufactured goods. Its domestic material consumption per capita is above the EU average despite steady but slow improvements in material efficiency in the last decade (EEA, 2011). This makes the economy vulnerable to volatility in international markets, especially in the light of increasing resource prices.

Primary energy intensity and greenhouse gases emissions have declined in Belgium since 1998, reflecting the decoupling of economic growth and primary energy consumption. However, in comparison to other Western EU countries, Belgium scores poorly in the economy's energy intensity indicator. Climate change mitigation related performance is another weak point of Belgium, mainly restrained by the power sector's market structures. For its electricity needs the country currently largely relies on nuclear (54%) and thermal power plants (39%). With the expected phasing out of the nuclear energy system[1] Belgium will soon be facing a major challenge in meeting its energy demands and transforming its energy supply system. Renewable energy, which has a small share now, is acquiring large attention; many enterprises and technology providers are emerging in this sector. However, a large potential rests in the eco-innovations involving low energy consuming practices in industry and housing, ICT solutions, etc.

Furthermore, Belgium has a large stock of old buildings with poor energy quality. The share of single-family stand-alone houses is high. At the same time the range of energy efficiency measures is less diverse in comparison to other European countries. All these contribute to a high energy and material intensity of the housing sector.

Mitigation of the local environmental problems represents a large potential for eco-innovations. According to the Environmental Performance Index (EPI, 2010) Belgium is ranked second lowest of the EU member countries. Poor environmental performance of the Belgian state has long been affected by a high population density in most of the country and a high level of economic and agricultural activities, particularly in the Flanders region. Among the biggest problems are the destruction and fragmentation of habitats, which have resulted in biodiversity losses, air pollution with its heavy burden on the ecosystem, and poor water quality. The latter being a result of the historical pollution accumulated in sediments and insufficient scale of sewage wastewater treatment.

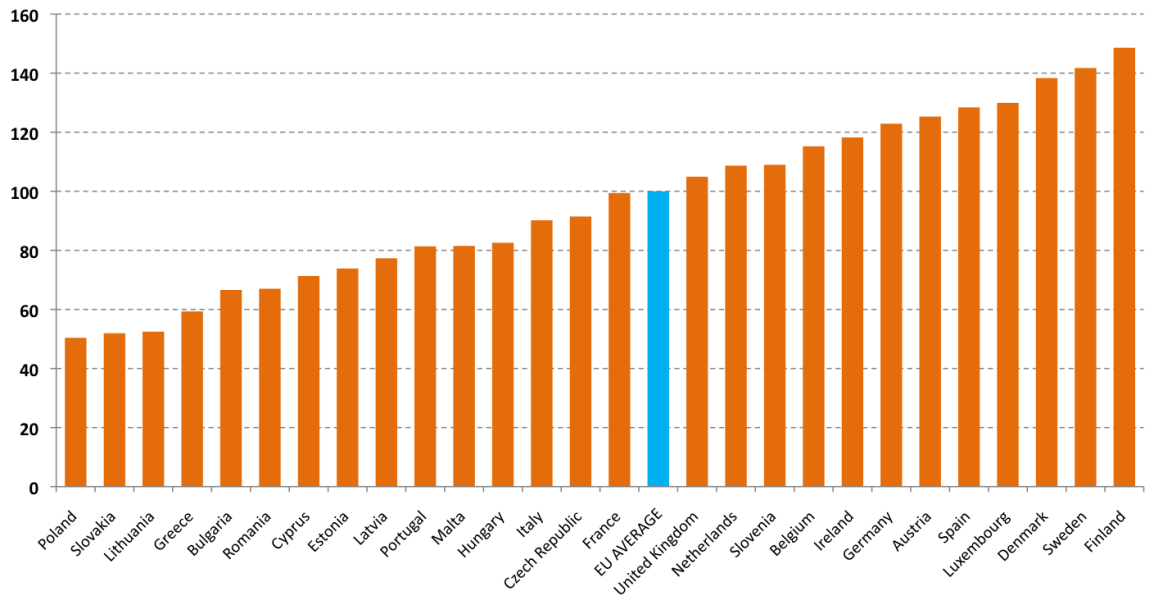
The for the coming decades forecasted population growth, intensified industrialisation and urbanisation, and climate change related problems, pose additional challenges for the country and call for a faster shift towards more sustainable and eco-innovative practices. In this context, existing and emerging systemic eco-innovative solutions offer significant potential to improve material productivity as well as overall economic and environmental performance of Belgium.

[1] Confirmed in current government negotiations (October 2011)

2 | Eco-innovation performance

The analysis in this section is based on the EU27 Eco-innovation scoreboard (Eco-IS) for the year 2011. Eco-IS via its composite Eco-innovation index shows the eco-innovation performance of a country compared with other member states and the EU average. The index is based on 16 indicators, which are aggregated into five components: eco-innovation inputs, eco-innovation activities, eco-innovation outputs, environmental outcomes, and socio-economic outcomes.

Figure 2.1 EU27 Eco-innovation scoreboard 2011, composite index



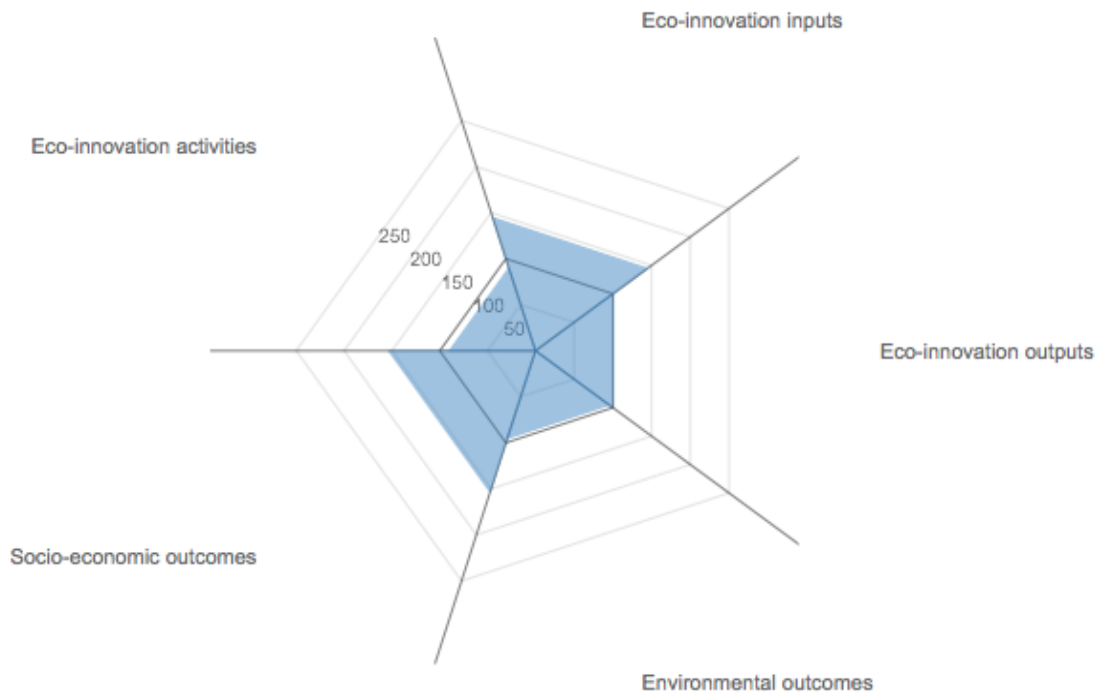
Source: EIO, 2011

The overall Eco-IS for Belgium is 115, while the EU27 average is 100 (Figure 2.1). This places Belgium ninth in the EU27 ranking of eco-innovative countries, in which Finland, Sweden and Denmark are the leaders. In comparison to the 2010 Eco-IS, Belgium's composite index has not changed significantly but its position in the EU27 ranking has moved slightly down. Caution should be used in comparing 2010 and 2011 indices, however, as the basket of indicators used in the 2011 scoreboard has been slightly modified (see URL for explanation about the composition of the scoreboard). Figure 2.2 below shows the performance of Belgium in each of the five components of the Eco-IS composite index.

Eco-innovation input

The eco-innovation input index is based on the national indicators of the government's environmental and energy R&D expenditure allocation, R&D personnel, and cleantech investment. In this component, Belgium is 44% above the EU27 average performance, and scores fifth after Finland, Sweden, Ireland and Denmark. The position of Belgium is largely due to the high values of indicators for cleantech investment and human capital. The overall performance of Belgium in this index has not changed much since 2010.

Figure 2.2 Components of the eco-innovation composite index for Belgium, 2011 (EU average = 100)



Source: EIO, 2011

In 2007-2009, Belgian cleantech projects attracted €196.66m of venture capital investment (Cleantech, 2009). The data does not provide technology and field related specifications, however, renewable energy, energy efficiency and transportation (electric vehicles, advanced batteries, fuel cells) constitute the largest share of the Cleantech venture capital statistics. The US Cleantech Trade & Investment Mission (2010) characterises Belgian cleantech and green energy markets as among the most dynamic in the world.

Belgium also has a good performance in its R&D personnel statistics (1.76% of total labour force), which is 22% above EU27 average level. This is one of the indicators of strong national technological and innovative capabilities in general; it is also an important condition for pursuing eco-innovation-related research and development.

In terms of the governmental appropriation for environmental and energy R&D (measured as % of GDP), Belgium's performance is far below the EU27 average level. With 0.03% of GDP allocations it scores 64, while the EU average is 100[2]. The complementary data for business expenditures is not available, which prevents us from seeing the whole picture on environmental R&D in the country.

Eco-innovation activities

In the eco-innovation activities index of the Eco-IS, Belgium scored below the EU27 average. The index is based on the statistics of companies with an ISO 14001 certificate[3] and business innovation activities aimed at material efficiency and energy saving sourced from the Community Innovation Survey (CIS).

In ISO 14001 certification (measured as the number of certified organisations per million inhabitants) Belgium scores 46 against 100 for the EU average. This is despite the fact that in recent years the

[2] However, it is necessary to note that the per capita measurement of allocations of environmental and energy R&D shows that Belgium has well above EU27 average performance (WIFO, 2009).
[3] Note: Eco-IS 2010 included EMAS certification.

absolute statistics of ISO 14001 certificates has been constantly growing with around 100-120 new companies acquiring the certificate annually. However, in comparison with other EU countries (such as Spain, Czech Republic, Sweden) this process has been less dynamic in Belgium.

According to the latest Community Innovation Survey (CIS 2008) around 13% of all surveyed Belgian companies reported an improvement in their material productivity resulting from innovation activities in 2006-2008. At 102, Belgium is slightly above the EU average (100) and in comparison to earlier surveys (CIS 2000, 2004, 2006) performance has significantly increased.

According to CIS 2008, 17.5% of all Belgian companies reported improvement in their energy productivity; a rate slightly above EU average. These statistics may reflect a trend towards an overall improvement of efficiency of production processes and might also be associated with the objectives to reduce production costs.

Eco-innovation output

The 2011 eco-innovation output index has been significantly modified and includes three indicators: eco-innovation related patents (OECD, 2008), publications (Scopus, 2011) and media coverage (Meltwater, 2011). Belgium's score in this index is close to the EU average.

Belgium's performance in the eco-innovation output index was largely driven by the publications statistics (per mln population); in this indicator Belgium scores 34% above the EU average. This shows that Belgium's academic community's focus on eco-innovation related topics is relatively high. However, Belgium's performance in this indicator is still far behind that of the top performers like Finland (345), Sweden (345), and Luxemburg (333).

Belgium's environmental patenting performance measured in number of environmental patents per million inhabitants is below the EU average (77 against 100)[4]. In this indicator Belgium is far below other western EU countries. This result is not surprising considering the relatively poorer patenting performance of Belgium in general (see IUS, 2010), as well as in environmental R&D allocations (see eco-innovation input indicator). However it is still rather striking considering the relatively good knowledge base (notably research and development personnel) as well as success in attracting green investments.

The results of the Meltwater media screening showed that media coverage of eco-innovation topics is slightly lower than in many other EU countries. In this indicator Belgium scores 90 against 100 for the EU average and against 300 for the top performers.

Environmental outcomes

The environmental outcome index is based on combined national statistics on domestic material productivity, domestic water productivity, inland energy productivity, and GHG emissions intensity. Belgium's overall performance in environmental outcomes is slightly below the EU average level (index = 95); it is also rather far below the top performers Luxembourg and the Netherlands (which are also immediate geographical neighbours). This index is comparable with the 2010 index, showing almost no variations in performance in GHG emissions and energy productivity (while domestic material and water productivity statistics were not updated).

[4] Note that Eco-IS 2010 measured the eco-patents statistics based on Emissions abatement and fuel efficiency in transportation PLUS Energy efficiency in buildings and lighting. In 2011 it has wider coverage and includes Energy generation from renewable and non-fossil sources PLUS Combustion technologies with mitigation potential PLUS Emissions abatement and fuel efficiency in transportation PLUS Energy efficiency in buildings and lighting PLUS Complementary Patstat queries by EIO team

As discussed in the 2010 brief, Belgian material productivity has been gradually improving over the years (from 1.29 €/kg in 2000 up to 1.56 €/kg in 2007). Similarly there has been a constant increase in energy productivity from 3.48 €/kg o.e. (oil equivalent) in 1995 up to 5.31 €/kg o.e. in 2008. Moreover, the carbon intensity of the economy has been declining from 0.78 kgCO2 equivalents per each euro of product in 1995 to 0.43 kgCO2 eq/euro in 2008. These macro level data go hand in hand with the micro (firm) level data from the CIS. Thus, this performance can be explained by improved overall efficiency in national industries, industrial resource consumption, as well as by a changing economic profile towards the service sector which has a less material intensive base.

In terms of water productivity which was 13.1 €/cubic meter in 2001, Belgium scores slightly above the EU average. However, Belgium's water footprint water footprint is 1802 m3/capita/yr, while the global average water footprint is 1243 m3/cap/yr. This places Belgium in the second most intensive water-consuming group of countries globally.

Socio-economic outcomes

The socio-economic outcomes index is based on data on the performance of "eco-industries"[5] including exports, employment and turnover. The overall performance of Belgium in this index is 53% above the EU average. In comparison to the 2010 Eco-IS, Belgium's position has improved (153 against 131) and it is shown to be the third top performer in the EU.

Belgium's high performance in this index can be explained by the country's relatively large and active eco-industry. It is a major source of employment; accounting for 3.22% of the total Belgian workforce, more than twice the EU average. Eco-industry turnover measured as share of GDP is almost 70% above the EU average. In both indicators Belgium is the third in the EU (behind Bulgaria and Slovenia), and is the highest in Western Europe. In eco-industry export indicators measured as a percentage of eco-industry goods in total export, Belgium scores 65 against 100 for the EU average. However, as the country's overall export volume is rather high, in absolute volume of eco-industry exports Belgium is one of the largest exporters in the EU.

[5] eco-industries include waste management, water supply and treatment, materials recycling, renewable energy, control of air pollution, soil, groundwater, noise pollution, and biodiversity protection areas.

3 | Established eco-innovation areas and markets

Many eco-innovative developments in Belgium are associated with its well established eco-industry sector, which is represented by companies specialising in renewable energy (bio-energy, solar cells, and wind turbines), water and waste management, air purification, soil remediation, energy efficiency, and sustainable construction. Along with addressing long standing local environmental problems, many Belgian eco-industry companies have also become technology leaders in international markets. In regards to the renewable energy technology market, Belgium is eighth in the world ranking of countries by clean energy technology sales (FEB, 2010).

Belgium's dependency on resource import made resource efficiency one of the focus issues (EEA, 2011). Many initiatives have been taken in **energy efficiency, sustainable construction** and **sustainable water management.** Eco-innovative activities in **urban greening** have continued to spread; some started moving further towards more systemic concepts of smart cities (discussed in Section 4). Furthermore, the initiatives on **sustainable mobility** have achieved some progress in 2011 and can be considered as one of the established leading eco-innovation areas in Belgium.

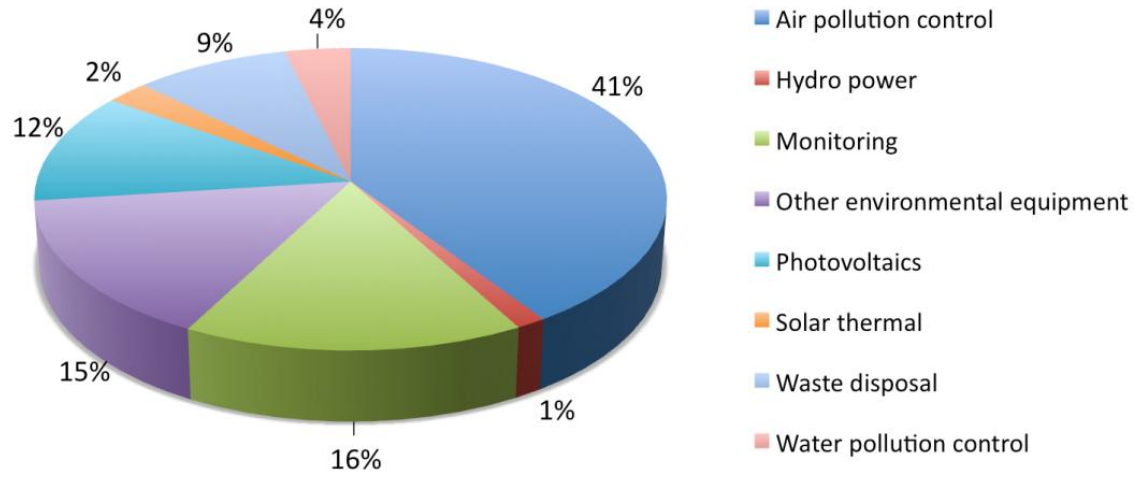
Several cities and towns in Belgium have introduced novel schemes of car sharing, city bicycle sharing, and soft mobility, which can also be considered as a potential example of **systemic innovations**. Attempts to change people's mobility patterns are being promoted with the new mobility concepts as "cycling instead of driving", as well as with revisiting the ownership concept with "renting a car instead of owning one". These ideas can potentially change the habits and attitudes of people and have an important contribution to a wider shift towards more sustainable lifestyles.

Eco-innovation markets

Belgian **eco-innovation markets** related information is mostly represented by the data for the eco-innovation industries, which also has a rather irregular nature. The eco-industry sector in Belgium is relatively large, so is its market with a turnover accounting 4.4% of the national GDP (which is the highest indicator in Western Europe) in 2008. The sector employs 3.3% of the total national workforce, which is a high number in comparison to other old EU states (Ecorys, 2008). Export volumes of the Belgian eco-industry sector are also quite high, being three to five time higher than in such countries as Finland and Austria. Figure 3.1 gives a sectorial break down of Belgian eco-industry exports. Although this data is rather old, it still gives an idea of the size of the leading eco-industry sectors.

While the market related data are not available for such eco-innovation areas as sustainable construction, eco-services, sustainable biotech, and energy efficiency, the expected potential is high. This potential is largely promoted by an increasing shortage of resources and stricter environmental standards, on the one hand, and a general shift towards a greener economy on the other. More investments are being diverted to eco-innovative projects and developments. The MIRA (2010) research report 'Sustainable savings and investments in Belgium in 2010' shows that from 1995 until 2010 the assets under management in sustainable and socially responsible investments (SRI) in Belgium increased from €8.9m to almost €10.98b. In 2010 only the Belgian SRI market rose by 8.3%. However, this data includes investment in the fields of environmental and social policy and sustainability and good governance and the report does not disaggregate these areas. Nevertheless, it is clear that investments in sustainability areas including environment are rapidly growing.

Figure 3.1 Eco-industry Exports by Sector in Belgium, 2004



Source: Ernst & Young, 2004

Sustainable urban mobility

Efficient mobility has long been an important issue in Belgium. The country is at the centre of transportation and shipping networks and has a massive population transit. In recent years the sustainable mobility concepts have been gaining importance and getting incorporated in the strategic plans of cities and provinces of Belgium. These plans have several targets (public transport, private car drivers, passengers, parking spaces) and aim at promoting more energy efficient transport behaviour through the development of new transport solutions and well-targeted campaigning.

The country has achieved some positive tangible results with the diffusion of innovative practices and pilot experiences, such as promoting non-motorised transportation (city-bicycle systems), automobile substitution schemes, green corridors, etc. In this respect the success of the "Villo!" bicycle-sharing programme in Brussels is very appealing (see details in the good practice example). Adjacent to this there is a "Bike to Work" motivational programme for employees and employers, providing benefits from a unique system of bike points, which may be exchanged for various advantages. Signs of a real market formation are seen in the car-sharing business: e.g. in Brussels two companies Cambio and Zen Car are competing in this market segment. Zen Car operates only electric cars, while Cambio is planning to introduce electric cars in the Brussels car park.

MOBIB: ticket to sustainable mobility scheme in Brussels

With the new innovative schemes of mobility in Brussels, its residents and visitors are becoming convinced of advantages of using eco-friendly, cheap and on your doorstep public transport in comparison to moving about by car. STIB/MIVB (Société des Transports Intercommunaux de Bruxelles/Maatschappij voor het Intercommunaal Vervoer te Brussel), which runs the entire network of the Brussels' underground, tram and bus lines, has focused on the development of new technologies and integrating the various forms of mobility schemes in the city including the Villo! bike-sharing scheme and Cambio car-sharing system.

Its MOBIB chip card offers a range of travel solutions. In addition to using the public transport including metro, trams, and buses (the card can store different travel formulas, which are cheaper than the paper ticket

versions), card holders are entitled to a discount when they use Villo! a bike-sharing scheme. The system consists of 180 stations located in many parts of the city, often in conjunction with metro and bus stations and open 24 hours a day year round, each containing 15-20 bike spaces. This amounts to about one station every 450 metres throughout the 11 communities of city, with over 2500 bicycles.

MOBIB card-holders are also entitled to a discount when they use the Cambio car-sharing scheme which has over 70 service points in Brussels. Every customer has the possibility of having a vehicle 24 hours a day and 7 days a week. The vehicles can be booked by via the internet or by telephone anytime. The travel time can be between one hour and 30 days. Depending on the station and the type of car, bookings with no end time specified are possible. The system is attractive to customers who make occasional use of a vehicle, as well as others who would like occasional access to a vehicle of a different type than they use day-to-day.

Such integrated mobility system allows a convenient living without a car for many residents of Brussels while contributing to improving air quality and traffic in the city.

Information source: http://www.stib.be/mobib.html?l=en; http://www.stib.be/mobib.html?l=en

Picture source: http://www.mivb.be

Zen Car electric car sharing system

The concept of car sharing was introduced in Belgium a few years ago. It promotes the car renting culture so that customers, in so far possible, do not need to own a car. By switching from a product to service oriented concept, car sharing potentially can have a large long term impact related to decreased material consumption. In Belgium a particular success has been achieved by companies Zen Car, which is a new comer using only electric cars and Cambio, which has had a longer presence in Belgium.

Zen Car car sharing is a model of electric car rental where customers rent cars for short periods of time, often by the hour. The system is attractive to customers who make occasional use of a vehicle, as well as others who would like occasional access to a vehicle of a different type than they use day-to-day. Rather than promote the automobile, the service aims on giving it a limited and reasonable use. The system is simple: take or drop-off a car at any of several parking points in Brussels. Every user has a monthly subscription and an electronic card for a key. Every subscriber has the possibility of having a vehicle 24 hours a day and 7 days a week. The vehicles can be booked by customers via the internet or by telephone anytime. The booking is transferred within minutes to the vehicle station. At the station, the key safe or vehicle can be opened with the customer's smart card. After returning the car, the trip-data for billing is transferred automatically to headquarters.

Zen Car parking points are conveniently located close to train stations and major points in Brussels. The company is constantly extending its network of stations and continues to expand.

Information source: http://www.zencar.eu/en/

picture source: Zen Car ©

Eco- and energy efficiency in buildings

The CAP 2020 cluster (CAP stand for “Constructeurs, Architectes, Producteurs”), formed in 2008, groups Walloon enterprises active in the building industry including contractors, architects, producers and suppliers of materials and services. The main priorities of the cluster are the reduction of energy consumption by 20% and achieving a 30% share of renewables in energy consumption by buildings. Another cluster, "Green building", born in 2004, focuses on responsible building considering respect of the environment by identifying the environmental impacts of construction projects; encouraging urban and architectural decisions that favour daylight (i.e. by including bioclimatic principles), ensuring a good thermal insulation of buildings; using low energy ecological or natural building materials; using building techniques that rely more on labour than high energy; and favouring “intelligent” building equipment.

In the Flanders region, there is a range of commercial and demonstration projects on erecting new eco-efficient buildings and refurbishing old houses initiated jointly by local municipality authorities and technology providers. Furthermore, the sustainable building concept is being developed in alliance with environmental impact and waste considerations and has become of particular interest to the Public Waste Agency of Flanders (OVAM), which has developed a tool that gives information on the environmental impact of the use of building materials. This ecological assessment of building materials is part of a more general standard for sustainable building and living, developed by the Flemish authorities in co-operation with the industry. With this standard Flanders wants to align itself with the World Green Building Council and with the EU objectives and legislation on sustainable building (OVAM, 2010).

The region of Brussels capital is populated with about 12 million m^2 of office buildings and about 500 thousand households. Eco-building has also become a priority for the Brussels government, along with the reduction of energy consumption, the choice of construction processes, the rational use of water and the use of eco-products and eco-materials. With the objective of making the sector more dynamic, the Brussels Enterprise Agency created in 2010 a sectorial cluster focussed on eco-building, which is the new manager entity of the EcoBuild cluster created in 2006. With around 40 members in 2010, the cluster encourages synergies between the various players in the sector including the private sector, research centres, support organisations, and institutions and universities.

Straw bale housing technologies from Casa Calida

Casa Calida is a Belgian organisation that promotes straw bale housing. Straw is a waste material from agriculture and it can be used for floors, walls and roofing. It is used both as isolation as well as building material. In construction of houses it is used in combination with a wooden skeleton, but single-storey buildings can be built just out of straw bales. A plaster coating makes the house waterproof.

Worldwide there are many examples of straw bale houses that are over a hundred years old. In fact these houses are still being inhabited. Straw bale housing became popular in the United States in 1980s and in Europe since the mid-1990s. The technique has been constantly tested and improved. People who live in straw bale houses are very satisfied with the durability, energy savings, and healthy living environment.

Casa Calida has built an expertise on straw bale house construction methods and promotes dissemination of this knowledge to a wider audience. It does this through workshops, fairs, and offering lodging in a straw bale guesthouse located in Tongeren, Limburg province of Belgium. The experience has been picked up by a number of enthusiasts in Belgium and the Netherlands who also managed to construct their own sustainable houses.

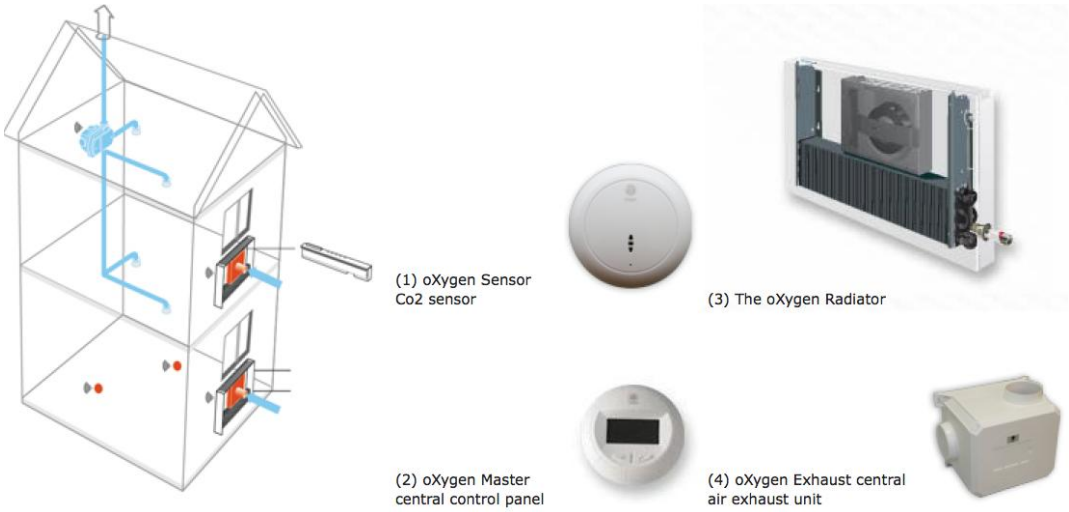
Information source: http://www.casacalida.be

Other examples are on http://www.onsstrohuisje.net/; http://strobalenhuis-wilderen.skynetblogs.be/; http://huisvanstro.skyrock.com/; http://www.bloggen.be/lapaillote/

Picture source: Casa Calida ©

oXygen - Energy efficient and smart radiator

In a great many of today's well insulated buildings, ventilation leaves much to be desired. Too much CO2 in the air indoors can lead to many complaints such as headaches, aggression, nausea and impaired concentration. In addition, high humidity means condensation. An ideal breeding ground for mildew and the dreaded dust mite. Opening a window for ventilation is not a good solution. The outside air that flows in is not always clean and an unnecessary amount of heat escapes through an open window – to say nothing of the noise and security risk.



oXygen system of Jaga company offers the solution in form of a monitored, balanced ventilation, which supplies only clean air when it is needed, keeps noise out and saves energy. Another benefit is Oxygen's energy-saving nature. The amount of ventilation depends on how stale the air is in every individual room, hence rooms with clean air are not ventilated unnecessarily. Research shows that the system has a beneficial effect on a building's energy performance. In the Netherlands, this has resulted in a significant improvement in the Energy Performance Coefficient from 0.15 to 0.20. This means that energy consumption falls by 15 to 20%, saving money and the environment.

Information source: http://www.jaga.be/oxygen/

Picture source: Jaga ©

Preventing and recycling waste through intelligent design

According to the European Commission figures, Belgium has the highest household packaging recycling rate in the European Union (93% in 2008). Its recycling for industrial packaging waste was 78.4% in 2008. A number of organisations set up by economic interest groups are overseeing successful waste sorting and recycling (e.g. Fost Plus focuses on household packaging, VAL-I-PAC on industrial packaging and Recupel on electric and electronic equipment). This is coupled with awareness-raising campaigns targeting the general public and specific stakeholder groups (FEB, 2010). Parallel initiatives have been implemented on a regional level.

The Walloon region has set ambitious targets related to waste management following the standards defined in the European Waste Framework Directive (Directive 2006/12/EC). The region has prioritised the maximum re-use of waste 'in-situ' and the "intelligent" use of raw materials by accounting for their impact on health and the environment. Encouraged by European and regional initiatives, notably through the solid waste cluster VAL+, the private sector in Wallonia has been mobilised and has developed expertise on techniques of composting based on natural and biological processes of conservation of organic materials from the agribusiness industry, or through maintenance of green areas and fermentable household waste. Biological processes, such as bioremediation processes through the use of hydrocarbons, are privileged for the treatment of polluted soils. Other examples include the neutralisation of polluting odours, water cleaning systems, the trade and recycling of non-ferrous metal waste, and the recycling of plastic products through mobile crushers and choppers. A support organisation and interest group, Recywall, born under the initiative of the Association of Research Centres in Wallonia, is concerned with the promotion of recycling and the valorisation of solid waste, by performing R&D. It groups seven research centres in different industrial sectors such as wood, ceramics, building, road construction, metalworking, plastics, paintings and coatings, textiles, and glass.

The Public Waste Agency of Flanders (OVAM) puts prevention of waste at its main objective and supports waste prevention initiatives in Flanders. The agency makes consumers and firms aware of the problem and encourages them to prevent waste through various awareness and incentive programmes, recommendations to local authorities, covenants with specific target groups, legal obligations, and experience exchange programmes. For unavoidable waste OVAM promotes recuperation, re-use and recycling of waste. Re-use centres are a very important channel for immediate re-use by the consumer. Overall, the Flemish waste management policy is closely intertwined with European legislation. In some cases, the EU law constitutes the starting point for the formulation of new Flemish rules on waste. In other instances, the Flemish waste management policy is ahead of European developments (OVAM, 2004).

"Cradle to Cradle" design by Desso

A Belgian- Dutch company DESSO is currently the only carpet manufacturer who applies the "Cradle to Cradle" design principles right across their entire company and processes.

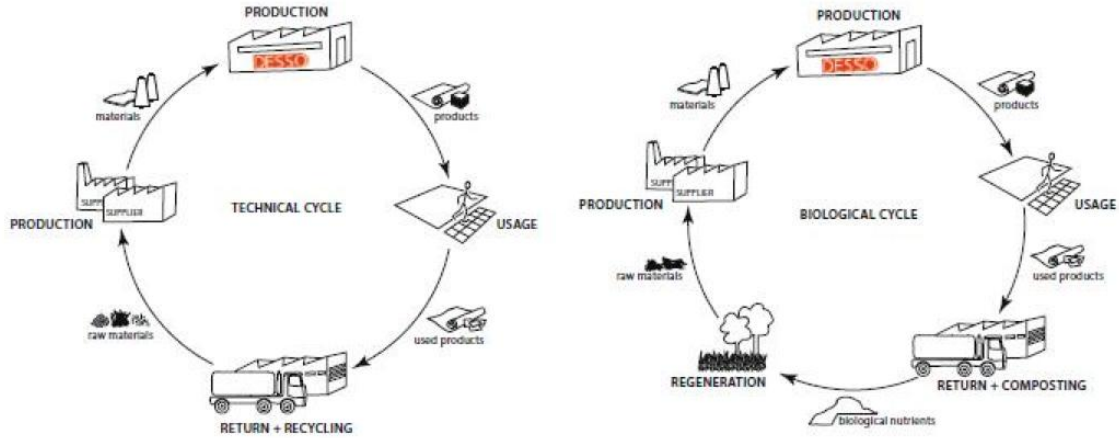
DESSO's 3 key drivers of innovation:

- Cradle to Cradle® manufacturing – total commitment across company & products
- Creative design – total focus on colour / texture / structure
- Functionality – improving environmental attributes through product design (indoor air quality)

With more than 80 years of carpet manufacturing experience, DESSO has earned an impressive reputation as a reliable partner and creative designer to the architectural and design industry. DESSO has four factories in Europe and specialist customer service centres throughout Europe, as well as in America, Asia, South Africa, the Middle East and Australia.

DESSO made the natural decision to take an alternative route and go a step beyond mere

sustainability and incorporate the Cradle to Cradle® principles in their design and production.



D ESSO have committed to designing their carpet and carpet tile products containing only pure materials which are safe for humans use; materials that are biologically or technically recyclable at the end of their useful lives.

DESSO also introduced a return system in which the company collects its customers' used carpets and recycles them into new materials used in carpet production. DESSO aims to produce all its carpets and artificial grass according to this principle by 2020.

Information source: http://www.desso.com

Picture source: DESSO ©, 2011

Ceramic building waste recycling by Wienerberger Belgium

As a producer of bricks and roof tiles, Wienerberger company “uses” nature in a kind of symbiosis: its clay extraction procedures are designed to minimize the impact on the environment and its clay-based products are ecologically friendly. The use of recycled ceramic material as new raw material for production is one of Wienerberger’s goals. The first applications are scheduled for a new plant in Belgium. For example, modern techniques for the identification of colour differences in rubble mean that ceramic materials can be separated from other building materials and returned to production.

Wienerberger works to complete the lifecycle of bricks through recycling. It has been trying to set up a system capable of filtering waste, in this case ceramic mass from worksite waste. On the one hand, ceramic materials that had been separated from other building rubble with a colour scanner were purchased and tested in production. The result was a reduction in raw material requirements. On the other hand, facade material from the demolition of houses is purchased and processed into brick flour which may be recycled for the production of facing bricks. Wienerberger plans to continue efforts to realize a complete, closed recycling process in brick production.

Wienerberger is one of the first to develop the method to separate out the red ceramic fraction from the grey concrete fraction using an optical technology. Once it is ground down, the ceramic mass can be reused as a raw material for building materials like bricks and roof tiles. The company is looking for the perfect sorting method. In addition, it wants to look into how the ceramic mass can best be ground and how the mass can be used as a raw material for new products. Furthermore the re-use of broken ceramic waste not only will result in savings of primary raw materials, but also a reduction in emissions and primary energy use since the material has already been fired.

Information source: http://www.wienerberger.com/sustainability/archive

Sustainable water

For many years, Belgium, especially the Flanders region, has been facing problems related to water quality due to intensive farming and industrial activities. Thanks to the governmental efforts the share of the population connected to a waste-water treatment plan grew from 26% to 46% over the last decade, the concentration of pollutants in many surface waters dropped, aquatic life became more abundant, and industrial water contamination continues to decline (WISE, 2010). These efforts along with the growing demand in the national market have become an important push factor for strengthening of the Belgian expertise in water management and development of the pool of companies with a solid R&D base specialising on water purification, management and recycling technologies. Many companies have become very competitive in the international market.

For example, Waterleau company is among the top three in the world in anaerobic treatment of wastewater technologies, as well as being one of the few in the world fully capable of handling end-to-end and integrated projects involving waste water, air purification, and energy production components. Other Belgian companies, BESIX Sanotec and Six Construct, are involved in the design, building, and maintenance of the world's largest drinking water production facility in Dubai. More Belgian expertise in water treatment can be found in various branches of SUEZ Environment, whose main Belgian specialists are Ondeo Industrial Solutions, Degrémont Benelux and technical firm Fabricom GTI. While the water treatment industry can be considered as a traditional eco-industry, there are many novel, more efficient and eco-friendlier technologies introduced by the Belgian companies (see examples in the 2010 brief). Several other companies have developed advanced water desalination technologies, provided electromechanical equipment used in water production plants and pumping stations, installed remote monitoring systems for pumping stations, water treatment plants and water towers (FEC, 2008).

4 | New trends and emerging eco-innovation markets

Emerging eco-innovation areas in Belgium include **biodegradable materials**, **products based on biosynthesis**, **hydrogen energy**, and **green architecture design**. Another noteworthy emerging eco-innovation area is **nanotechnology**. Furthermore, the more systemic innovations toward **sustainable urban lifestyle** have been actively promoted to improve environmental situation and community health in densely populated cities. With the shift towards systemic thinking and analysis of the current unsustainable practices, more attention is being given to systemic, radical and transformative, innovations. The “Transition management” programme pursued by the Flemish government, for example, sets the pathways to radical changes in entire value chain practices. Producers do not focus only on recycling, but rather on waste prevention that can be achieved by redesigning their product and value chains. A good set of examples of chain thinking models and technologies in textiles, furniture, and construction material production exist in Belgium. More practices that focus on services rather than products are still to be expected.

Comprehensive systemic solutions for sustainable urban systems have been strongly promoted in the last year. Several factors contribute to the upcoming of new promising eco-innovation areas and markets in Belgium. One example is the strategic investment, both public and private, in R&D that pushes boundaries of specific technologies and increases awareness of the general population about the need for change towards sustainability. Assessment of the markets for upcoming eco-innovation areas is generally missing, however clearly the potential of these markets are promising.

Systemic solutions for sustainable urban areas

Sustainable cities are rapidly becoming important strategic themes in Belgium and likewise in many other EU countries. There is a growing understanding that due to a city's compact structure and high population density, sustainability measures will have a greater effect there. Many cities and towns in Belgium already have community initiatives on the promotion of sustainable neighbourhoods; with people being actively involved for example in greening and recycling projects (see the good practice example of Brutopia - Brussels neighbourhoods). With the European Industrial Initiative around Smart Cities setting the tone, Belgian cities and organizations have turned their focus on developing a more integrated approach to urban sustainability including a large spectrum of issues (e.g. energy, waste, materials, closing the recycling loop, water, green in the city, air quality, health, mobility, sociological issues, viability, ecosystem services). One example of such an initiative is the ‘Drivers of Urban Sustainability’ Task Force initiated by the Flemish Institute for Technological Research (VITO, 2011), which is also involved in designing the pilot CO^2 negative neighbourhood in Leuven (see the good practice example of Tweewaters).

Brutopia: bottom up initiatives to build a sustainable neighbourhood

BRUTOPIA is a joint housing project in Brussels. It was started by an initiative of a group of people who desired to change their living style in a way that is both collective and ecologically responsible. The idea pursued by the projects is to live, work and to have leisure without having to make long trips while enjoying the best offered by the city. In other words the project intends to promote a sustainable location, combined with "soft"mobility.

The project is the joint quest for a future residence, purchase, construction (or renovation) of the residence and living together in that place. All phases of the project are characterized by some form of 'common nature'. The physical space is divided into a private area (house/apartment) and a common

part which is managed jointly. The common part includes not only garden and elevator, but also laundry facilities, solar panels, etc. How extensive this common part depends on the wishes of all members of the association.

The concern for the environment was taken through the entire design and implementation of the project, starting from selection of location to the type of construction and finishing materials, and especially choosing the heating system and insulation measures. The architect engineers who have been invited for the project are the ones with a particular interest in eco-building. Besides the projects benefited from the expertise of a number of specialists in sustainable constructions and energy.

The idea of sustainable living also crystallized around the issue of mobility of residents. Different ways to reduce car use were explored. The close proximity to the Brussels public transport and train network was one of the decisive criteria in choosing the land plot for the project. Cycling and car sharing are also very much encouraged among Brutopists. In fact, the car sharing will administered by the specially established organization called Autopia which will take care of accounting, insurance, etc. A number of cars for share will be available at the parking lot on the territory of the housing association. It is necessary to note that the association decided on much smaller number of parking spaces and garages that normally would have been allowed for similar size of neighbourhood. Instead it is planning on having more space for bicycle and motorcycle parking, and intends to install facilities for electric cars. Other ideas planned to be implements are vegetable gardens on the rooftops, composting, natural air cooling and filtration facilities, “flower meadows” with native plants, childcare, etc.

Information source: http://utopiabrussels.files.wordpress.com

Picture source: Brutopia Project ©

TWEEWATERS – sustainable and smart city district

The ambitious Tweewaters project located along the Leuven Canal Basin is a good example of a holistic view of urban development. Project developer Ertzberg company intentionally opted for sustainability as leitmotif in developing the 11-hectare project area into a 21st century district.

To this end, the multidisciplinary team of Ertzberg called upon experienced industrial partners such as VITO, Eneco, Energy IT and Canalco.

According to the project designers the district will generate its own green electricity and green heating, and even supply energy to the surrounding neighbourhoods. This will allow a saving of more than 9000 tonnes of CO2 yearly. Thus Tweewaters is an important pilot project for CO2 negative neighbourhoods in Belgium. The focus, however, is not on energy alone. With Tweewaters, Ertzberg has opted for a holistic approach. All the intertwined aspects of the society that have an impact on the ecological footprint are given due attention: energy, water, waste, use of materials, mobility, use of space, consumption.

With its 'Urban convenience' vision for the district, Ertzberg tries to show that ecology and comfortable living can go hand in hand. It does not concern – as many fear – less architecture, less aesthetics, or less convenience but rather innovation and intelligent solutions. The project is an appeal to cities, project developers, material producers, and energy companies to examine our cities with an open mind and a broad vision.

Information source: www.tweewaters.be
http://www.vito.be/VITO/EN/HomepageAdmin/Home/Nieuws/Nieuwsberichten/VISION_08_Focus.htm

More information: guy.vekemans@vito.be

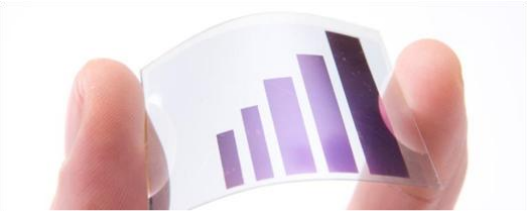
Pictures' source: Tweewaters ©, 2011

Nanotechnology for sustainability

The nanotechnology related R&D has been on a rise in Belgium according to the OECD database (2011); the major bulk of nanotechnology patents in Belgium are focused on the fields of chemicals, materials, pharmaceuticals and biotechnology. Along with that there is a growing recognition that nanoscience and nanotechnology can have a profound impact on the total chain of energy production: from the generation of energy, the conversion of energy from one state to another, storage, transport and its use.

The development related to using nanotech for sustainability and environment has been emerging under the materials technology and sustainable chemistry research programmes of the VITO - Flemish Institute for Technological Research. Examples to name are reactive nano-materials that can degrade water soil pollutants compounds (e.g. AOX, chlorinated solvents) via chemical oxidation or reduction processes. At the same time the Belgian Interuniversity Microelectronics Centre (IMEC), which is one of the world-leaders in research in nanoelectronics, has been looking into cheap nano solar cell concepts with high efficiency. Together with its spinoff, Photovoltec, IMEC has been pursuing collaboration that presently is covering development of a solar cell technology based on super-thin crystalline Si solar cells and development of novel surface passivation layers. Another stream of IMEC's successful research is organic photovoltaics, in which the concept of stacked multifunction gives a promising efficiency improvement, while spray-coating technology has a much lower cost in comparison to existing alternatives.

Organic solar cells - Rethinking the value chain in PV technology



Organic solar cells have the potential to become a cost- and resource efficient alternative to silicon solar cells. And they can be a solution for special applications, applied on irregular, flexible or transparent substrates. IMEC (Interuniversity microelectronics centre) aims to increase the efficiency and lifetime of organic solar cells, and to develop a manufacturing technology for all layers of organic monolithic modules.

Active layers of organic solar cells are typically 100nm to several µm thick. Therefore only small quantities of active material are needed. In addition, the printing technology to deposit these layers allows for extremely high production throughputs. Taken together, this could lower the costs of such cells with a factor 5 to 10 compared to today's solar cell technologies.

One of the most promising concepts in the field of organic solar cells is that of the bulk donor/acceptor heterojunction. Here, the active layer consists of an intimate mixture of two different conjugated organic materials sandwiched between metallic electrodes.

IMEC's R&D pursues 2 main routes. The first one looks at polymer-based organic solar cells in which the active layer can be processed from a solution. Typically this is done through spin-coating, and recently IMEC made successful steps towards using printing technology such as screen printing. Secondly, active organic layers using small conjugated molecules can be deposited by vacuum evaporation.

Information source: http://www.imec.be/ScientificReport/SR2009/HTML/1213462.html

Picture Source: IMEC ©

Eco-innovation in industrial biotech

While the dominant share of the Belgian biotech companies is active in pharmaceuticals and agriculture biotech, there are developments in the industrial biotech sector, which focuses on bioprocessing technologies ranging from the production of enzymes to algae. Industrial biotech developments offer many opportunities for eco-innovations associated with using renewable resources such as sugars or vegetable oils to produce a wide variety of fine and bulk chemicals, biocolorants, solvents, bioplastics, vitamins, food additives, biopesticides, enzymes, and biofuels.

The Flanders region has 24 companies working solely in industrial biotechnology (FlandersBio, 2009). The dominant focus has been on bio-fuels; the region has established the largest integrated bio-energy production complex in Europe. There is also the Flanders Institute for Biotechnology, which is a European leader in scientific research and technology transfer, and IMEC promoting combined research on bio- and nanotechnologies. The Walloon region also hosts a very dynamic biotech sector including ‘biotechnopoles’ in Liège (BioLiège), Charleroi (BioVallée), Gembloux-Namur (agri-food), Louvain-la-Neuve. Around 20% of its companies deal with agriculture and waste remediation. Several of the Wallonian companies carry R&D on bioproducts that can successfully substitute current chemical and petrochemical based products (see examples in the 2010 brief).

ALCHEMIS - Algae for chemicals and emission abatement

Scarcity in fossil based resources and the need for climate change mitigation face the chemical sector to find alternative resources and to reduce greenhouse gas emissions. Algae have the potential to solve part of these issues. However the analysis of algae production shows that energy use and use of fossil based nutrients have a very big impact from both the perspective of production costs and sustainability.

MIP Vlaanderen has initiated the ALCHEMIS project on production of algae which aims to address the problem of use of energy and nutrients in the production. The ALCHEMIS project examines the production of algae based on flue gasses and waste water. Besides the production of algae also the harvesting is examined and an assessment is made of the market for algae.

The important task of the project is the reduction of energy costs through improving the photobioreactor and harvesting technology. Regarding the nutrients, the only solution considered is the use of “waste“ nutrients. This project aims to demonstrate the production of algae on flue gasses and waste water in an algae farm with a production surface of approximately 500 m². This farm will have a production volume of approximately 4000 kg algae dry matter (DM) per year. This size allows to demonstrate the feasibility of larger scale algae production, to produce large enough quantities of products for functional testing and at the same time to keep the algae quantities manageable. In this configuration an algae farm closes the loop by using waste to produce new, high value materials.

- The most important issues that will be addressed in the project are: Developing and building of a large-scale demonstration installation for algae biomass production in Flanders.
- Use of CO2 and NOx from waste gasses and “waste” nutrients from wastewater for algae production and determination of the influence of contamination on the use of the algae and thus on the product development.
- Combination of different concentration methods to achieve the best and most economical concentration method.
- Research on recycling of the effluent of the harvesting installation as growth medium in the reactor. Influence of metabolites of the algae on the growth of the algae.
- Development of downstream processing based on available technologies for other biomass resources and research on wet downstream processing and based on market opportunities.
- Design of a marketing plan for algae biomass in different production quantities.

Information source: http://www.mipvlaanderen.be/en-us/webpage/132/alchemis-eng.aspx

Closing material cycles via biodegradability

There are new initiatives and developments in Belgium trying to prevent waste by closing material cycles. In this approach, waste is reclaimed by nature or used as raw material in a new process and the composition of the product is being put in the centre of the design phase (FEB, 2010). Within this broad field of waste management, a number of Belgian companies are boasting technology and expertise that encompass not only collection and sorting but also waste recovery. Some companies go even further and try to prevent waste by redesigning their products and processes. For example, there are chain thinking models and technologies in textiles, floor carpets, furniture, construction material production, etc. (see examples from the 2010 brief), which are gradually arriving in the market and one can expect their further successful dissemination. Furthermore, closing the material cycle and waste prevention is also one of the focus areas of the “Sustainable Material Management" programme promoted by the Flanders region (OVAM, 2010).

5 | Public policy in support of eco-innovation

Belgium has a well-established tradition in environmental and innovation policy. However, the comparative analysis by the WIFO (2009) suggests that the overall institutional framework conditions for eco-innovation (including availability of funding, flexibility, transparency, enforcement of environmental regulation, etc.) are still less favourable in comparison to the situation in other Western European countries. According to Belgium's ETAP roadmap the eco-innovation concept is well embedded in Belgian global and integrated innovation policies, while the Belgian government shows full subscription to the Lisbon goals. The roadmap focuses on bringing synergies between growth, development of employment and environmental protection, and encourages basing best practices on these three priorities. In its policy agenda the country uses ETAP's definition of eco-innovation[6] (WIFO, 2009). In implementing the ETAP roadmap the Federal and Regional governments have their own areas of emphasis in terms of areas of focus (see description below).

Public policy supporting eco-innovation

In general Belgium's eco-innovation policy is represented by a mix of first and second generation policies[7], while Flanders region has moved towards a third generation policy by adopting the "Sustainable Materials Management" Programme under the "transition management" approach. In this programme the system innovation and sustainable transition platforms are being put forward; a more integrated approach, which recognises the cross-links between the ecologic, economic and social aspects is envisioned to bring about a shift in thinking, producing, consuming, trading and governing, thereby maximally safeguarding the environmental impact (EEA, 2011).

A number of supply and demand side policy measures have been adopted to facilitate eco-innovations in the country (see Figure 5.1 and Annex 1 for the overview of the policy measures). In promotion of innovation and R&D, which also address eco-innovations there is a range of **supply side** incentive mechanisms, such as allowances, subsidies and tax breaks for R&D activities and employees. Several public and private sources of funding are available for start-ups, entrepreneurs and established businesses, along with specialised training, advisory and networking support.

A set of **demand** side policy measures has also been developed to support eco-innovative activities, products and services. Environmental and sustainability requirements have been introduced in public procurements procedures. The *ecocheque*, a wage premium focusing on environmentally-friendly consumer goods is given to all employees and exempted from income-taxation. Some support is provided for research-to-market projects and technology adopters through special funding schemes. It is necessary to note that there are still problems with flexibility, transparency, enforcement of environmental regulation, as well as availability of funding (WIFO, 2009).

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[6] *The EU Environmental Technology Action Plan (ETAP) defines eco-innovation as "the production, assimilation or exploitation of a novelty in products, production processes, services or in management and business methods, which aims, throughout its lifecycle, to prevent or substantially reduce environmental risk, pollution and other negative impacts of resource use (including energy)". The EU is discussing the renewal of the ETAP as the Eco-Innovation Action Plan from 2011. The new plan will reflect the extension of the eco-innovation concept by embracing non-technological aspects of eco-innovation such as innovation in business models and increasing attention to the diffusion and commercialisation stages of eco-innovation on top of research and development.*

[7] *First generation policies support mostly innovative solutions improving pollution control and other end-of-pipe environmental technologies; Second generation policies support eco-innovation resulting in greater resource and energy efficiency in production processes. There is a realisation that eco-innovation can have both economic and environmental benefits; Third generation policies support systemic (transformative and radical) eco-innovations aiming at changing production and consumption patterns. Measures include value chain management, re-designing cities, industrial ecology/symbiosis, new business models providing alternative solutions (e.g. product service systems)*

Figure 5.1 Policy measures addressing eco-innovations in Belgium

	Group of policy measures	*Type of policy measure*	**Focus of policy measures** (tick if applies)				
			Generic focus on eco-innovation	Resource efficiency improvement	Energy efficiency improvement	Reduction of emissions incl. CO2	Other relevant areas (e.g. renewable energy, etc)
SUPPLY SIDE FOCUS	**Equity/business support**	Venture capital funds					
		Public guarantee funds					
	Support for R&D in public sector and industry	R&D funding	X	X	X	X	X
		Collaborative grants	X		X	X	X
		R&D infrastructure	X				
	Fiscal measures	Tax incentives for R&D and start-ups					
		Tax incentives for R&D personnel					
	Education, training and mobility	Tailored training courses for companies, entrepreneurs	X				
		Advise/consulting for start-ups, companies, entrepreneurs	X				
		Placement schemes for students					
		Support for R&D workers recruitments					
	Networks and partnerships	Competence centres, clusters, science-technology parks		X	X	X	X
		Technology platforms and innovation networks	X				
		Foresight and common vision building	X	X	X	X	X
		Market intelligence and other forms of information sharing	X				
DEMAND SIDE FOCUS	**Regulations and standards**	Regulations, targets, cap & trade schemes		X	X	X	X
		Performance standards, labelling, certification	X				
	Public procurement	"Green" public procurement of goods and services	X				
		R&D procurement					
		Pre-commercial procurement					
	Technology Transfer	Advisory support for technology adopters	X				
		Financial or fiscal support for technology adopters (e.g. grants for purchasing new technology)	X	X	X	X	X
	Support of private demand	Tax incentives for consumers (e.g. for purchasing environmentally efficient products)	X				
		Tax reductions for products and services (e.g. VAT reductions)					
		Demand subsidies (e.g. eco-vouchers, consumer subsidies)	X				
		Awareness raising and information provision	X			X	X

Policy-making and governance in Belgium is implemented on the Federal and regional/language community levels. Regional governments have a considerable autonomy in all policy fields. Each has very independent eco-innovation policy agendas and developed a region oriented set of policy measures.

Federal policies

The Federal level develops 'instrumental' competences in support for the effective implementation and market translation of the regional objectives and initiatives, which mostly entail fiscal and quasi-fiscal provisions, taxation, competition rules, market structures, price regulation, etc. There are a number of plans and strategy documents on the Federal level enabling an institutional and market environment for eco-innovative solutions, including notably:

- the Federal Plan for Sustainable Development;
- the Federal Products Plan aiming to reconcile economic growth with a decoupling, in absolute terms, of environmental impacts caused by products;
- the National Climate Plans;
- the National Air pollution abatement Plan;
- The NEHAP, National Action Plan for Health & Environment;
- National Biodiversity Strategy complemented by a Federal Plan for Integration of biodiversity in four key areas (Economics, Science Policy, Mobility, Cooperation for Development);
- the Federal Programme for the reduction of agricultural pesticides and biocides.

In 2011, on the Federal level the policy developments have been hindered due to delays in the formation of the Belgian Government.

Flanders region

In the Flanders region sustainable development, innovation, globalisation and green economy are put in the centre of the regional plan Flanders in Action (VIA) and the resulting Pact 2020 (VIA, 2010). One of the objectives focuses on the improvement of eco-efficiency of the Flemish economy. The key areas are SMEs, logistics & infrastructure, innovation and knowledge economy, energy and eco-efficiency. One of the actions of the VIA is development of a green and dynamic urban region which promotes such projects as “Intelligent electricity network” (Smart Grid), “Smart living”, “Renewable energy”, “Sustainable materials”, “Eco-friendly transport”, “Socially caring cities”, “Positive project for Brussels”.

Approved in November 2010 the Flemish Reform Programme (which is an implementation tool for the priorities of the EU2020 Strategy) includes the Sustainable Materials Management (SMM) programme. While promoting this innovative programme the region has advanced towards third generation policies by incorporating the systemic change perspective and transition concepts and intends to set up guidelines for scaling up both on federal and EU levels. One of the experimental instruments promoting systemic approach is Plan C.

Among other relevant strategies promoted in the Flanders region is the 4th Environmental Policy Plan (MINA-4) for 2011-2015, which foresees to stimulate environmental friendly production and consumption. It includes objectives for 2015 on eco-efficiency, the consumption of materials, natural resources and energy, the use of substitutes and renewable energy. With regard to biological resources, it proposes actions to integrate the concept of ‘ecosystem services’ within the Flemish policy context, and to develop instruments to support the supply of ecosystem services (EEA, 2011).

A Green Paper for a New Industrial Policy in Flanders focuses on increasing productivity gains within a knowledge economy and targets (among other) energy and material efficiency.

The region’s Energy Efficiency Action Plan contains targets on energy savings in accordance to the EU climate and energy package and lists actions to be taken by different sectors.

Figure 5.2. Plan C – experimental platform for systemic eco-innovations

The OVAM, the Flemish Public Waste Agency, concluded that a next generation of waste management – or 'sustainable material management' – requires room for changes in perspective and practice, for new structures and culture, for (failure-friendly) experiment and social learning, and cannot be controlled or planned.

From this deeper understanding and concern to make future progression, the OVAM started **Plan C**, a transition network that brings together individuals and organisations (from the public sector, the business world, academia and NGOs) to co-create breakthroughs in sustainable material management. A specific approach was implemented to manage this complex process: transition governance.

Plan C shows that this approach towards system innovation really can make a difference. Plan C offers a visionary framework and initiates and assists in a coordinated effort for experimenting along selected pathways. Experiments are 'innovation projects with a societal challenge as a starting point for learning', looking into the proper technological, juridical, economical and social bottlenecks on the journey towards breakthroughs in the way to manage material resources.

Some examples of experiments are situated in the field of product-service systems, chemical leasing, closed loops of materials, product design, local production and consumption, etc.

Source: EEA, 2011

Among the relevant initiatives pursued in Flanders region are:

DuWoBo (the abbreviation stands for Duurzaam Wonen en Bouwen / Sustainable Living and Building), an innovation platform which aims to translate the principles of sustainable development to one of Flanders major economic sectors, i.e. building and living;

the Environment and Energy Technology Innovation Platform (MIP) which invests in eco-innovation and a green and sustainable economy by subsidising companies and research centres developing new and innovative sustainable technologies and products;

the Eco-efficiency Scan programme seeking to encourage Flemish SMEs to invest in improving their eco-efficiency;

the Sustainable Technology Development (STD) facility, a horizontal support measure for R&D projects initiated by companies, universities and research institutes, which supports projects pursuing one or more of the seven innovation objectives: reduce raw materials, save energy, reduce emissions, reduce waste and other environmental pollutants, develop renewable raw materials and energy sources, enhance the recyclability of raw materials, and increase the lifespan of products.

Wallonia

In Wallonia support for eco-innovation is framed in its Marshall Plan 2.Green, the Future contract for Wallonia, the Air-Climate Plan, and the regional Sustainable Development Strategy. Adopted in 2009 the Marshall Plan 2.Green aims at improving the competitive position of companies integrating sustainable development as a policy goal. The Plan is centred around six priority axes and involves several measures that are important in the context of eco-innovations, including:

- Creation of the cluster (*pôle de compétitivité*) dedicated to new environmental technologies;

- Creation of Employment-Environment alliances focusing on the energy and sustainable construction sectors;
- Encouraging sustainable development initiatives by local companies (SME, artisans) through specific innovation grants;
- Focusing efforts on eco-designs through different measures throughout companies.

The Air-Climate Plan (2007) of Wallonia contains about a hundred concrete measures to address the climate change problems and improve the air quality, such as reducing greenhouse gases, NOx and SOx emissions, establishment of regulatory instrument, raising awareness, and informing citizens, etc. These measures are coordinated and funded by nine Walloon Ministries.

Future contract for Wallonia introduced in 2004, is an integrated development strategy with ten years perspective. Until 2007, measures mainly targeted disadvantaged groups of population and focused on providing equal opportunities for them. Current measures also target companies, which among other issues address eco-innovation.

The Walloon region promotes its eco-innovations through "green clusters": CAP 2020, focussing on the building industry and energy consumption reduction; solid waste cluster VAL+ (or "cluster déchets solides"); "Green building" cluster; and the TWEED cluster or "Sustainable Energy" cluster, focusing on renewable energies, energy efficiency and climate impact in industries and services sector, and "green" products and services. These clusters are part of the Walloon legislation for the support and development of business networks and clusters (The Portal of the Walloon clusters, 2010).

Brussels Capital region

In the Brussels Capital region, the eco-innovation is reflected in the Regional policy statement 2009-2014, which set the aim for Brussels to become a role model in sustainable development, open to innovation, development, production, and commercialisation of environmental products and services of high-added value. The region has an ambitious policy vis-à-vis energy policy in which priority is given to energy efficiency. Being a signatory of the Covenant of Mayors, the city government promotes a set of activities on energy efficiency and climate change mitigation. Eco-buildings development has been prioritised through EcoBuild cluster. The regional waste plan foresees a resource efficient policy for the construction sector, and specific approaches by other waste streams.

Brussels also leads a **green public procurement** policy, which is translated in a ministerial circular that mentions the product and service groups for which green criteria has to be taken into account for public procurement. Sustainable management of water resources in the Brussels region is addressed by the Water management plan. A Sustainable food plan (without legal character) resumes all the measures taken to promote sustainable food (EEA, 2011).

6 | Main findings

6.1 Strengths and weaknesses of Belgium in promotion of eco-innovations

Current **strengths** of Belgium in promotion of eco-innovations are in its relatively active and advanced eco-industry and cleantech sector; many companies give high priorities to their R&D activities and some are the world leaders in a specific technologies. Many sustainable solutions on resource efficiency, closing the material cycle, etc., come from eco-industry companies. This also explains Belgium's better experience with attracting cleantech investments. The country also has a relatively strong tradition in venture capital investments.

Belgium has a strong pool of innovative companies, universities, research labs, and a well-trained human capital such as R&D personnel, engineers and businessmen. The country has one of the highest shares of population with tertiary education in the EU. Its human resources in science and technology represent over 30% of total employment, and the number of science and engineering degrees as a percentage of all new degrees is on the level of the world leading economies (OECD, 2008). While this factor is important for overall innovativeness in the country, it is also crucial in eco-innovative uptakes, especially the ones based on scientific research and technical developments.

Figure 6.1 Strengths and Weaknesses of Belgium in promotion of eco-innovations

Strengths	Weaknesses
- well established and innovative eco-industry sector - growing cleantech investments and better in comparison to other EU countries venture capital traditions - large and highly skilled human capital in knowledge intensive fields - growing baseline consensus on the green agenda and diverse regional level initiatives and programmes addressing eco-innovation development	- long lasting delay in formation of the Central government, which hampers progress in federal policy making - for most industries and businesses, environmental protection and the greening of the economy are still considered to be a cost rather than an opportunity - comparatively (to neighbouring countries) low investment in environmental and energy R&D - insufficient enforcement, lack of flexibility and transparency of environmental regulation - still insufficient awareness and lack of systemic understanding of eco-innovation challenges

Among the main drivers of the current eco-innovative activities in specific areas is the promotion of dedicated initiatives and programmes under the patronage of regional authorities and the application of specific measures. Baseline consensus on the green agenda has been growing in recent years in the political community of Belgium. An important point in this is the involvement of various actors in these initiatives: first of all the private for-profit enterprises, as well as various local non-governmental organisations and local public authorities.

Current **weaknesses** of the country hindering eco-innovative development are associated with several factors. Despite a strong tradition in environmental policy and good innovation potential, the overall institutional framework conditions for eco-innovation, including availability of R&D funding, flexibility, transparency, enforcement of environmental regulation, etc. is still less favourable in comparison to the situation in other Western European countries.

On the federal level, the policy progress has been hampered by the absence of the federal government. Overall political instability in the national governance has its influence in political decision-making and

implementation in many areas, including innovation, industrial, environmental policies which are important in the promotion of eco-innovation.

Although the awareness about eco-innovation has been growing (among policies, businesses and population) it is not yet on a sufficient level and there is still a lack of systemic understanding of eco-innovation challenges. Most industries and businesses still consider environmental protection and the greening of the economy as a cost rather than as an opportunity.

6.2 Opportunities and threats to eco-innovation in Belgium

There are a number of trends observed in Belgium, which can bring **opportunities** for developing and implementing eco-innovation in the future. Local and international demand for eco-innovative products and services has increased in the last decade. More and more people prefer buying bio-products and product with eco-labels, which has created special niche-markets and spurred businesses of many companies. Furthermore, more companies are aspiring to get an environmental certificate for their activities, requiring them to use and produce eco-friendly services and products. Green public procurement has not yet created a massive demand, but there are positive developments there. These trends will only increase in years to come, which will provide good opportunities for eco-innovative products, services, business models and production processes.

Figure 6.2 Opportunities and Threats for eco-innovations in Belgium

Opportunities	Threats
- growing demand (local and international) for eco-innovative products and services - high dependency on imported raw materials and exposure to volatilities of resources markets encourages innovations at companies - transition towards a third generation of environmental policies in which system innovation and sustainable transition platforms are put forward in Flanders region - commitment of the governments to the general green policy agenda	- continuing economic downturn that might divert economic priorities over environmental - insufficient awareness and lack of systemic understanding of eco-innovation challenges - dependence on and favouring international standards and markets rather than developing domestic solutions

The Belgian economy is highly dependent on the import of raw materials therefore it is exposed to volatile changes in market prices for resources. However, the predicted increase of world prices for natural resources creates a great motivation for Belgian companies to introduce resource efficiency measures, and reconsider their values chains, while on the national level the strategies encouraging dematerialisation of the economy will be receiving a priority. In this respect the experience with the newly launched Sustainable Materials Management Programme in Flanders will be very valuable, both in achieving an absolute decoupling and in further transition towards third generation policies on a larger scale.

The potential **threats** to eco-innovation in Belgium can be coming from the continuing economic downturn, which might place economic priorities before environmental objectives. Furthermore, insufficient awareness and lack of systemic understanding of eco-innovation challenges (which still largely persist now) can prevent a more fundamental shift towards a systemic approach in addressing eco-innovative development and green growth.

Finally, Belgium's small market and thin demand creates dependence of the local companies on external markets, which in turn can make them to favour international standards rather than developing domestic solutions.

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Annex 1. Policy measures addressing eco-innovations in Belgium

	Group of policy measures	***Type of policy measure***	***Specific measure*** *Please provide reference to or brief summary of specific measures (national, regional)* add cells if necessary	**Focus of policy measure** (tick if relevant)				
				Generic focus on eco-innovation	Resource efficiency improvement	Energy efficiency improvement	Reduction of emissions incl. CO2	Other relevant areas (e.g. renewable energy, etc)
SUPPLY SIDE FOCUS	**Equity/business support**	Venture capital funds	Business Angels Network (BAN) Flanders The BAN is a broker between business angels and companies in need of venture capital, bringing both parties together and stimulating investments in innovative companies. Wallonia/Brussels-Capital - Business Angels Networks A number of networks of Business Angels are promoted and supported in the Walloon region of Belgium as well as in the region of Brussels-Capital with a view to providing a complementary source of finance to innovative small businesses. -					
		Public guarantee funds	Brussels-Capital - BRUSTART-Seed fund is a subsidiary of the SRIB (Regional Investment Company of Brussels) providing financial solutions to young innovative companies that are in the launching or starting-up phase. Brussels - Funding for pre-competitive development The measure provides funding to promote pre-competitive research by large enterprises as well as SMEs operating in the Brussels-Capital region. Funding can take the form of a grant or a zero-interest rate loan Wallonia - FIRD (Fund for the industrialisation and commercialisation of the results of research financed by the Region) aiming at providing equity and loans to enterprises wishing to exploit the results of research Wallonia - FIRST Enterprise spin-out FIRST Enterprise spin-out was created in 2005 with the aim to foster the creation of spin-outs through the financing of an entrepreneurial-minded person within a company, which will exploit a technology available within a company but which is outside its core-business, in a new company.					
	Support for R&D in public sector and industry	R&D funding	Flemish Sustainable Technology Development (STD) facility is a horizontal support measure for R&D projects initiated by companies, universities and research institutes Brussels-Capital - Direct subsidies for industrial R&D Federal research programme - Science for a Sustainable Development – focused on supporting scientific research organisations via grants and promotion of partnership Wallonia - Technology Mobilising Programme WINNOMAT 2 - Wallonia - Engineering - Materials – support for applied and pre-competitive research Wallonia - Innovation grant The innovation grant aims at supporting enterprises in	X	X X	X	X	X

	Group of policy measures	***Type of policy measure***	***Specific measure*** *Please provide reference to or brief summary of specific measures (national, regional)* add cells if necessary	**Focus of policy measure** (tick if relevant)				
				Generic focus on eco-innovation	Resource efficiency improvement	Energy efficiency improvement	Reduction of emissions incl. CO2	Other relevant areas (e.g. renewable energy, etc)
			targeting their activities on innovation in order to get new market shares, products or niches. Wallonia - FIRST Enterprise spin-out FIRST-Spin-off grants support for projects aiming at the development of a new product, process or service; and the undertaking of a technical-market feasibility study for the exploitation of the results and a business plan, with the general view of launching a spin-off in the Walloon Region IWT – Flemish Agency for innovation by science and technology: Provides funding for innovative projects of companies, research centres, organizations and individuals in various fields					
		Collaborative grants	Grants by Flanders: MIP, Environmental and Energy Technology Innovation Platform for university-company collaborative projects Sustainable Technology Development (STD) facility (in Flanders) is a horizontal support measure for R&D projects initiated by companies, universities and research institutes	X		X	X	X
		R&D infrastructure	Investment for infrastructure is provided via R&D funding schemes, as well as in targeted investment for specific research institutions and projects	X				
	Fiscal measures	Tax incentives for R&D and start-ups	R&D Tax Credit Federal measure. This tax credit applies only to patents and assets tending to promote the research and development of new products and advanced technologies which have no effects on the environment or aim at reducing the negative effects on the environment. Federal measure on Tax deduction for R&D investments and patents acquisition The investment allowance permits the deduction, from the tax base, of a quota of the amount of investments made in the course of the tax period. Tangible and intangible investments in R&D or patents allow the application of an increased rate of deduction Winwinloan (winwinlening)- tax incentive for investors in start-ups in Flanders Federal - Tax deduction for patent income	X				
		Tax incentives for R&D personnel	Partial exemptions of advance payment on wages in favour of employers who employ researchers is an instrument of the federal government which offers deductions in wage taxes, under certain conditions, for researchers in public research institutions and private companies.					

	Group of policy measures	***Type of policy measure***	***Specific measure*** *Please provide reference to or brief summary of specific measures (national, regional)* add cells if necessary	**Focus of policy measure** (tick if relevant)				
				Generic focus on eco-innovation	Resource efficiency improvement	Energy efficiency improvement	Reduction of emissions incl. CO2	Other relevant areas (e.g. renewable energy, etc)
	Education, training and mobility	Tailored training courses for companies, entrepreneurs	Brussels Enterprise Agency (BEA) is an important source of information and professional tools for start-ups, SMEs and foreign investors with regard to training, financing, public aid, planning regulations, partnerships, environmental permits and other formalities. All advice is provided free of charge.	X				
		Advise/consulting for start-ups, companies, entrepreneurs	IWT – Flemish Agency for innovation by science and technology: provided advice to companies and research organizations on innovation projects start, implementations, funding, and in technology transfer, support collaboration and networking Environmental Technologies business unit of the Brussels Enterprise Agency (BEA), provided consulting and education services for companies on business development, partnering, financing, localisation etc.	x				
		Placement schemes for students	Belgium takes part in the ERASMUS-MUNDUS student exchange programme					
		Support for R&D workers recruitments	Special scheme exist for mobility of academic workers (e.g. exchange/ attracting foreign researchers)					
	Networks and partnerships	Competence centres, clusters, science-technology parks	Clusters Walloon: out of 15 clusters supported on Walloon four have direct relevance to eco-innovation: Solid waste, Eco-building, TWEED (Energy savings/sustainable development technologies), CAP2020 (Building) Number of science and technology centres (among other focusing on environmental technologies) exist in Flanders and Brussels region		X X	X X	X X	X X
		Technology platforms and innovation networks	Federal Programme to stimulate knowledge transfer in areas of strategic importance (TAP2)	X				
		Foresight and common vision building	Environmental Outlook 2030 Flanders produced by MIRA ETAP roadmap for Belgium, 2006	X	X	X	X	X
		Market intelligence and	Environmental Technologies business unit of the Brussels Enterprise Agency (BEA),	X				

	Group of policy measures	*Type of policy measure*	***Specific measure*** *Please provide reference to or brief summary of specific measures (national, regional)* add cells if necessary	**Focus of policy measure** (tick if relevant)				
				Generic focus on eco-innovation	Resource efficiency improvement	Energy efficiency improvement	Reduction of emissions incl. CO2	Other relevant areas (e.g. renewable energy, etc)
		other forms of information sharing	provided consulting and education services for companies on business development, partnering, financing, localisation etc.					
XDEMAND SIDE FOCUS	**Regulations and standards**	Regulations, targets, cap & trade schemes	Walloon's Air Climate Plan (2007) contains ±100 measures to address the climate change and improve air quality, establishment of regulatory instrument, raising awareness, and informing citizens, etc. Flanders region's Pact 2020 formulates targets on decoupling, emissions, waste, ecological footprint. MINA-4/4th env policy plan of Flander set targets on eco-efficiency, material consumption, energy efficiency and renewable energy Brussels region has a set of regulations and targets on energy, waste , water, etc		X X	X X	X X X	X X X
		Performance standards, labelling, certification	Eco-dynamic enterprise label is an initiative of the Brussels Institute for Management of the Environment (BIME); encourages enterprises based in Brussels to voluntarily take the necessary precautions with regards to the environment.	X				
	Public procurement	"Green" public procurement of goods and services	"Catalytic eco-procurements" project under the Flemish Action Plan on Procurement of Innovation (2008) Brussels Government's "Circular of February 5, 2009 relating to the inclusion of criteria pertaining to environmental issues and sustainable development into government supply and service contracts". The National Strategy for Sustainable Public Procurement 2004-2008 Sustainable Public Procurement guide by the Federal government practical tool for purchasing goods and services with a reduced environmental and social impact throughout their entire lifecycle. Currently, the guide covers label information for more than 200 products	X X X X				
		R&D procurement	"Catalytic eco-procurements" project under the Flemish Action Plan on Procurement of Innovation (2008)	X				
		Pre-commercial procurement						
	Technology Transfer	Advisory support for technology adopters	Brussels-Capital - Spin-off in Brussels aimed at both academic spin-offs (universities and polytechnics) and industrial spin-outs (enterprises and collective research centres). Funding is provided for an initial two year period, which is essentially a pre-incubation phase. Academic spinoffs receive 100% funding of the costs they					

	Group of policy measures	*Type of policy measure*	***Specific measure*** *Please provide reference to or brief summary of specific measures (national, regional)* add cells if necessary	**Focus of policy measure** (tick if relevant)				
				Generic focus on eco-innovation	Resource efficiency improvement	Energy efficiency improvement	Reduction of emissions incl. CO2	Other relevant areas (e.g. renewable energy, etc)
			incur, while industrial spin-outs receive 75%.					
		Financial or fiscal support for technology adopters (e.g. grants for purchasing new technology)	Flanders: PRODEM - Promotion and Demonstration of Environmental Technologies The project encourages SMEs to introduce environmentally friendly process technologies, by setting up demonstration tests and pilots to investigate the feasibility of selected technologies since this was found crucial for SMEs to guide them to do the right investments in cleaner technologies. Flanders: Technology Transfer Fund (TETRA) provides support for research and knowledge diffusion for a group of interested parties, composed of one or more applicants (Higher Education Institutes (HEIs) including universities) and a group of users (companies and other organisations). Wallonia - Innovation grant The innovation grant aims at supporting enterprises in targeting their activities on innovation in order to get new market shares, products or niches. The project	X X	X	X	X	X
	Support of private demand	Tax incentives for consumers (e.g. for purchasing environmentally efficient products)	Eco-tax law covering a range of products. The main aim of eco-taxes is to change the structure of relative prices, thus providing an incentive to change the consumption patterns in an environmentally friendly way.	X				
		Tax reductions for products and services (e.g. VAT reductions)						
		Demand subsidies (e.g. eco-vouchers, consumer subsidies)	ecocheque - wage premium focusing on environmentally-friendly or 'green' consumer goods	X				
		Awareness raising and information provision	there are many activities aimed at awareness raising promoted through local community governments, environmental agencies, etc. Walloon's Air Climate Plan (2007) contains ±100 measures to address the climate change and improve air quality, establishment of regulatory instrument, raising awareness, and informing citizens, etc.	X			X	X

About the Eco-Innovation Observatory (EIO)

The Eco-Innovation Observatory (EIO) is a 3-year initiative financed by the European Commission's Directorate-General for the Environment from the Competitiveness and Innovation framework Programme (CIP). The Observatory is developing an integrated information source and a series of analyses on eco-innovation trends and markets, targeting business, innovation service providers, policy makers as well as researchers and analysts. The EIO directly informs two major EU initiatives: the Environmental Technologies Action Plan (ETAP) and Europe INNOVA.

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