Green jobs

Final report

On behalf of:

Federal Public Service Employment, Labour and Social Dialogue

IDEA Consult in collaboration with RDC Environment and 3E

Valentijn Bilsen
Stephanie Devisscher
Debbie Sanders
Miriam Van Hoed
Marc Bosmans (RDC Environment)
Florian Leblanc (RDC Environment)
Antoon Soete (3E)

Brussels, May 2010

IDEA Consult nv
Kunstlaan 1-2, bus 16
B –1210 Brussels

Tel: (+32) 02 282 17 10
Fax: (+32) 02 282 17 15
www.ideaconsult.be

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Part 1: INTRODUCTION

1 INTRODUCTION

1.1 Context of the study

Two major environmental challenges that will be faced in the 21st century are climate change and environmental degradation. Creating a "green economy" is regarded by policy makers as one of the key objectives for the EU to address these challenges but also to reinforce economic growth and create jobs. The green economy is therefore regarded as a gateway to a more sustainable economy.

Increasing interest in the green economy has resulted in a wide range of policy plans and thematic platforms on this subject, on the international, European, national and regional levels. However, there is still no political consensus on the definition of the "green economy" which makes it quite difficult to discuss the role of policy makers.

On the 1st of July 2010, Belgium takes over the EU Council Presidency from Spain. Employment and the green economy will be high on the agenda.

Greening the economy is more and more considered to be one of the key objectives for the EU. It is often linked with climate change and emission reductions but greening is actually a phenomenon with a broader base including the preservation of biodiversity, the prevention of pollution...

1.2 Aim of the study

IDEA Consult is providing analytical support to the Federal Public Service Employment, Labour and Social Dialogue in order to contribute to the thematic work on green jobs during the preparation of the EU Council Presidency. The aim of the project is threefold:

1. To provide a comprehensive conceptual framework which allows to relate, identify and distinguish a myriad of concepts such as 'green economy', 'eco-industry', 'green jobs', 'environmental policy', and to describe the profile of the Belgian green economy

2. To analyse the opportunities, threats and challenges with respect to the development of the 'green economy' for the Belgian labour market,

3. To identify priorities for labour market policy with respect to the evolution of green jobs in Belgium and for the EU as a whole

1.3 Structure of the report

This report contains the final report of the study on 'green jobs'.

Part 2 shows the results of the literature analysis concerning concepts and definitions of green economy and green jobs, and describes the conceptual framework for this study.

In part 3, an overview of the available data on the green economy is given. Based on national data, a quantitative profile of the green economy in Belgium is presented.

Part 4 goes deeper into two sectoral case studies: green building and renewable energy.

Part 5 shows the possibilities and approach for setting up a monitoring instrument for green jobs.

In Part 6, the conclusions and recommendations are presented.

Part 2: CONCEPTUAL FRAMEWORK

1 OVERVIEW OF EXISTING CONCEPTS AND DEFINITIONS

Given the wide range of literature already available on the topic of green jobs, it is interesting to get a clear view on the different concepts and definitions. Because of the variety of interpretations of 'green economy' and 'green jobs', we have identified in Chapter 2 a clear conceptual framework to structure the discussion and to define in a clear and concise way the focus for the later phases in this project, i.e. the quantification of the green economy in Belgium and the identification of the policy options to stimulate this green economy.

1.1 Existing concepts and definitions

The existing literature is mainly internationally oriented. The following table shows the most important concepts and definitions used in the international literature concerning the green economy on the one hand, and green jobs on the other.

Table 1: International concepts and definitions concerning the "green economy"

Concept	Source	Definition
Eco-industry	OECD/ Eurostat[1]	Activities which produce goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems concerning waste, noise and eco-systems. This includes technologies, products, and services that reduce environmental risks and minimize pollution and the use of resources.

[1] EUROSTAT (1999), The Environmental Goods and Services Industry. Manual for data collection and analysis, Luxemburg.

Environmental goods and services	Eurostat/ OECD[2]	The Environmental Goods and Services Sector consists in a heterogeneous group of producers of technologies, goods and services that: • Carry out measurements, controls, restoration, prevention, treatment, minimisation measures, research and awareness-raising concerning environmental damage to air, water and soil as well as problems related to waste, noise, biodiversity and landscapes. This includes "cleaner" technologies, i.e. goods and services that prevent or minimise pollution. • Carry out measurements, controls, restoration, prevention, treatment, minimisation measures, research and awareness-raising concerning the depletion of resources. This results mainly in resource-efficient technologies, goods and services that minimise the use of natural resources
Eco-industries	IDEA Consult/ ECORYS NL[3]	The **'core'** of the eco-industry, i.e. "those [identifiable] sectors within which the main – or a substantial part of – activities are undertaken with the primary purpose of the production of goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems." **Connected** industries, then, are to be interpreted as industries where the production of goods and services to measure, prevent, limit minimize or correct environmental damage to water, air, and soil, and of problems related to waste, noise and eco-systems are only the secondary purpose.

Source: IDEA Consult based on literature review

[2] EUROSTAT (2009) Data Collection Handbook on Environmental Goods and Services Sector, Final Draft, Eurostat Unit E3 – Environment Statistics, March 2009, ENV/EXP/WG/07 (2009), 201 pp.

[3] IDEA Consult (2009), Study on the competitiveness of the EU eco-industry – Final Report Part I, Published by the European Commission DG Enterprise & Industry, Brussels.

Table 2: International concepts and definitions related to "green jobs"

Concept	Source	Definition
Green jobs	UNEP[4]	We define green jobs as work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but non-exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, material and water consumption through high-efficiency strategies; de-carbonize the economy and minimize or altogether avoid the generation of all forms of waste and pollution.
Green jobs	ILO[5]	"Green jobs" do not lend themselves to a narrow definition but it certainly includes direct employment which reduces environmental impact, ultimately to levels that are sustainable. This includes jobs that help to reduce the consumption of energy and raw materials, decarbonizes the economy, protect and restore ecosystems and biodiversity and minimize the production of waste and pollution. A somewhat broader concept of "green jobs" might embrace any new job in a sector which has a smaller than average environmental footprint and contributes to improving overall performance, albeit perhaps only marginally.

Source: IDEA Consult based on literature review

[4] UNEP (2008), Green jobs: Towards decent work in a sustainable, low-carbon world, Worldwatch Institute, Washington DC.

[5] ILO (2008), Global challenges for sustainable development: strategies for green jobs, ILO Background Note G8 Labour and Employment Ministers Conference Niigata, Japan.

The international concepts of 'green economy' and 'green jobs', as proposed by organisations like Eurostat, the OECD and the ILO, are clearly **activity-based**. This means that the concept is based on existing economic activities and sectors which are active in the green economy as a function of the way they contribute to a better environment, whether it is their primary purpose to do so or not. The shades of green vary from one activity to another, and definitions differ in terms of scope. Whatever the case, green jobs are taken to mean employment in these sectors and activities regarded as green. However, we have also noticed that many international publications discuss green jobs without a clear concept or definition as a starting point e.g. Employment in Europe (2009)[6], Dublin Foundation (2009)[7].

Political views on the concepts of 'green economy' and 'green jobs' sometimes deviate from the existing international concepts. We recognize nonetheless that policy makers are very concerned about the impact of their policy on the 'greening of the economy' e.g. the promotion of teleworking, public transport, etc. As will be discussed further, the jobs generated through this type of policy measures cannot necessarily be classified as green jobs. The impact of various policies, with or without environmental focus, lies outside the scope of this study since it involves a thorough impact assessment rather than a study useful for defining labour market policy priorities. In the following parts of the study we will refer to this view as the **policy impact concept** (or policy-based concept) of the green economy.

An activity-based concept has the advantage that it answers the question of "What is the green economy?" By clearly identifying activities and sectors, we can measure the green economy quantitatively, e.g. the added value, employment, etc. A policy-based concept looks at the economy in a much broader approach. We go deeper into the dynamism of the green economy and the influence of policy in the next chapter.

[6] EC (2009), Employment in Europe, Chapter 3: Climate change and labour market outcomes, p.105-145.

[7] European Foundation for the Improvement of Living and Working Conditions (2009), Greening the European economy: Responses and initiatives by Member States and social partners, Dublin, 25p.

2 CONCEPTUAL FRAMEWORK

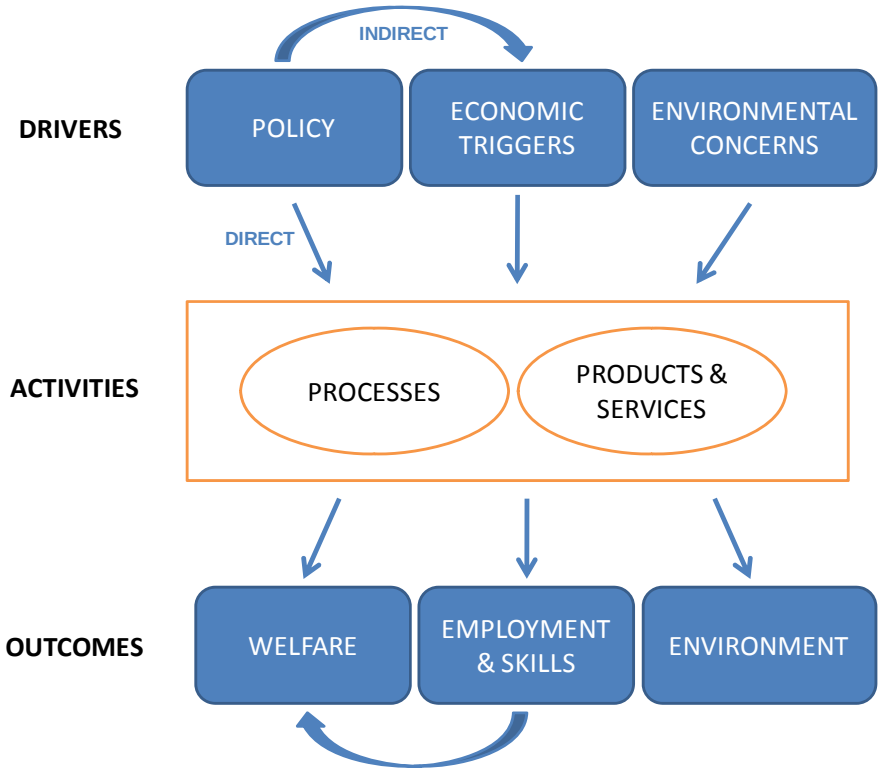
As illustrated above, there is a wide variety of views and interpretations of concepts related to the green economy. We have therefore endeavored to structure the thinking process by creating a conceptual framework that covers the different viewpoints.

2.1 The green economy

The following diagram provides us with some insight into the different ways of looking at the concept. We distinguish between three levels of conceptual thinking:

- **Drivers**: What determines the green economy?
- **Activities**: What are its actors doing?
- **Outcomes**: What are the results of the green economy?

Figure 1: The macro-components for the conceptual framework



Source: IDEA Consult based on literature review

Activities

We start with the 'activities' as these have a central place in this framework. Most international definitions focus on **products and services** in their definition of the green economy. The OECD/Eurostat manual, for instance, talks about "activities which produce goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems. This includes technologies, products, and services that reduce environmental risk and minimize pollution and resource use".

This means that a part of the economy is regarded as green, while the other part is not. However, it is clear that in practically all sectors and activities of the economy, 'efforts' are made to reduce the environmental impact. **Processes** are adapted by e.g. using more recycled material as raw material; consuming less energy in the production process or preventing emissions. This is a much more *dynamic viewpoint* but is therefore much more difficult to measure.

Products and services are linked to production *processes* as they partly constitue the input for these processes e.g. renewable energy, filters for cars...

Drivers

The drivers of the green economy, whether we consider processes or products and services, are numerous. **Economic drivers** are still the key for business decisions as costs and benefits of investments are compared. For example, as prices for fossil fuels rise, investments to improve the energy efficiency of the production processes become more profitable and the use of renewable energy rises.

However, **policy makers** can have a major impact as well as we have seen in Europe during the last decades with the reinforcement of environmental and climate policy. Policy has two main effects on the "green economy":

- **Directly** by imposing norms with regard to the production processes or the quantity or quality of products and services, e.g. emission norms for cars, fish quotas, the energy performance of buildings…
- **Indirectly** by creating economic incentives that can trigger changes in the production processes or the quantity or quality of products and services, e.g. the creation of emission trading schemes (resulting in a price for emissions), taxes and fines on pollution, subsidizing the installation of solar panels, awareness-raising of the public and of companies...

Of course, there are also **drivers** related to environmental concerns, for example the increasing public perception of the need for a more sustainable economy, which leads to a higher demand for green 'products and services'. Also among entrepreneurs there is an increasing awareness for corporate social responsibility and for the triple bottom line "People, planet, profit".

Outcomes

The effects of the green economy are threefold:

- **Welfare**: What is the impact on living standards in a broad sense, including wellbeing?
- **Employment and skills**: What are the net employment effects for the economy? It clearly created jobs in the 'green sectors' but how does that compare with jobs disappearing in other sectors and activities (e.g. traditional industrial sectors)? How does the demand for skills change as a consequence of the emerging new jobs, the change in existing jobs or the disappearance of jobs?
- **Environment**: In which way does the green economy really contribute to a better environment or dealing with climate change?

2.2 Components of the green economy

In order to determine the components of the green economy, we have developed a framework using an **activity-based** approach of the green economy with a focus on **products and services**. The reasons why we used this focus are numerous:

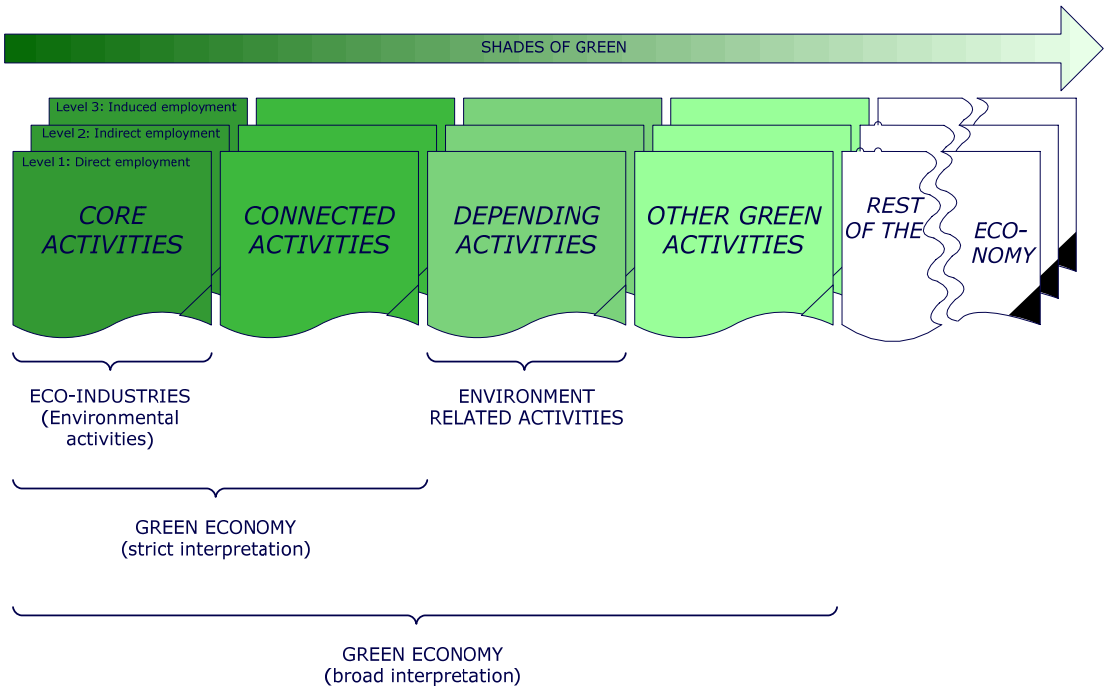
- It is in line with international literature and policy and therefore it builds further on the development of existing concepts, most notably by Eurostat and the OECD.
- It is a concept that is measurable since it is closely linked with the conceptual framework of Eurostat and the OECD. Their concepts were developed with measurement purposes in mind. Especially in comparison with the dynamic nature of 'processes', the activity-based approach is easier to quantify, given the available economic data covering sectors and activities.
- It is expected that a green labour market policy benefits from a clear and focussed definition of green economy rather than from a broad concept.

The next figure presents the concept that will be used in this study.

An explicit choice is made to use the term **activities** rather than sectors. Traditional sector and subsector classification is not always the most adequate for covering the 'green economy'. More and more, 'green niches' are becoming apparent in traditional sectors, and many sectors have activities with different shades of green.

The shades of green become lighter as we move from left to right in the figure. As we can see, the 'rest of the economy' has no colour in this concept. If one were to build a conceptual framework based on 'green processes', we would see that every economic activity would have a certain shade of green.

Figure 2: Conceptual framework of the green economy



Source: IDEA Consult based on literature review

The shades of green in this figure are based on the intended impact on the environment rather than the real impact. **Core activities** have as a primary purpose the protection of the environment and include the clearest green activities. Examples of these activities are the recycling industry, the production of renewable energy, etc.

Connected activities can be seen as the 'green' branch of traditional sectors like transport, construction, agriculture. Market opportunities lead to green niches like the production of hybrid cars, recycled paper, green building… The protection of the environment is not the primary purpose of the sector as a whole but it is significant on a secondary basis. These activities can constitute a more environmentally friendly alternative for traditional products and services.

Some activities are called **dependent** activities because they depend heavily on environmental quality. The activities do not have the explicit purpose of contributing to the protection of the environment. Agriculture, forestry and tourism are some clear examples.

Other activities like public transport or ICT contribute to the environment but have in principle never had it as a major objective.

The table below compares the main characteristics of these four types of green activities.

Table 3: Characteristics of the different types of green activities

Type	Purpose of protecting the environment	Examples
Core activities	Primary purpose	Environmental protection: air pollution control, protection of biodiversity, waste management Resource management: water management, renewable energy, recycling
Connected activities	Secondary purpose	Hybrid cars, green building, green ICT, organic farming, sustainable tourism, sustainable forestry
Dependent activities	No environmental purpose but dependent on environmental quality	Agriculture, commercial forestry, tourism
Other green activities	No environmental purpose	Public transport services, ICT

It was argued above that the most fruitful and promising way to define green jobs is by referring to the nature of the activities that the jobs are related to or used for. To put it concisely, according to this perception green jobs are jobs in green activities. It has been argued that alternative views are certainly worthwhile conceptually, yet from a concrete measurement point of view are not always practical.

Policy-making starts with adequate observation. With this concern in mind, an overview of green activities is presented in this section, which subsequently can be translated into sectors.

Given the body of data that are currently available or being developed, we believe that the most promising way forward to get a clearer view on the green jobs is to use an activity classification and definition that closely relates to Eurostat's definition of EGSS.

Table 4 provides a list of **core activities** under the proposed concept of 'green economy'. Our suggested list is compared with the one compiled in Eurostat's EGSS Data Collection Handbook and with the classification used in the Belgian Federal Planning Office study on the environment industry. The core activities are explicitly defined as a function of their explicit environmental purpose.

Table 4: Identification of green activities in the core segment of the Green Economy

EGSS Handbook (Eurostat)	Sectors (FPB-study)	Our study: a suggestion	Remarks
	Production of equipment and specific materials, provision of services and construction and installation for:	**Core activities (primary purpose is environmental)**	The provision of clearner technologies, products in the FPB study is included in all the other categories
Environmental Protection (CEPA classification)	**Pollution management group**	**Environmental protection**	
CEPA 1. Protection of ambient air and climate	Air pollution control (A.1.1., A.2.1, A.3.1)	Air pollution control	
CEPA 2. Waste water management	Waste water management (A.1.2., A.2.2., A.3.2)	Waste water management	
CEPA 3. Waste management	Solid waste management (A.1.3., A.2.3., A.3.3.)	Waste management	
CEPA 4. Protection and remediation of soil and surface	Remediation and clean-up of soil, surface water and groundwater (A.1.4., A.2.4., A.3.4.)	Soil groundwater and surface protection and remediation	
CEPA 5. Noise and vibration abatement	Noise and vibration abatement (A.1.5., A.2.5., A.3.5.)	Noise and vibration abatement	
CEPA 6. Protection of biodiversity and landscape	-	Protection of biodiversity and landscapes	The FPB study classifies Environmental protection with resource management
CEPA 7. Protection against radiation	-	Protection against radiation	The FPB study classifies Environmental protection with resource management
CEPA 8. Research and development	Environmental research and development (A.1.6., A.2.6.)	Research and development	
CEPA 9. Other environmental protection activities	Environmental contracting and engineering (A.1.7.) Analytical services, data collection, analysis and assessment (A.2.8) Education, training and information (A.2.9.) Construction and installation for environmental monitoring, analysis and assessment (A.3.6.)	Other environmental protection activities	
Resoure Management (CReMa classification)	**Resource management group**	**Resource management**	
	Indoor air pollution control (C.1.1., C.2.1., C.3.1.)		
CREMA 10. Water management	-	Water management	
CREMA 11. A. Management of forest areas	Sustainable forestry (C.1.7., C.2.7.,)	Management of forest resources	
CREMA 11.B. Minimizing the intake of forest resources		Recyling (part of)	EGSS devides recycling across 3 activities
CREMA 12. Management of wild flora and fauna	-	Management of wild flora and fauna	
CREMA 13.A. Management of energy resources: renewable energy	Materials, services, construction for renewable energy plants (C.1.4., C.2.4., C.3.4.)	Renewable energy production	
Hydropower		Hydropower	
Geothermal energy		Geothermal energy	
Solar energy		Solar energy	
Wind energy		Wind energy	
Tide wave and ocean energy		Tide wave and ocean energy	
Solid biomass		Solid biomass	
Wood, wood waste other solid waste		Wood, wood waste other solid waste	
Charcoal		Charcoal	
Biogas		Biogas	
Liquid biofuels		Liquid biofuels	
Municipal waste (combusted biodegradable material)		Municipal waste (combusted biodegradable material)	
Combustable renewables and waste		Combustable renewables and waste	
CREMA 13.B. Management of energy resources: Heat/energy saving	Heat / energy saving and management (C.1.5., C.2.5., C.3.5.)	Heat/energy saving and management	
CREMA 13.C. Minimization of the intake of fossil resources for raw materials for other use than energy	-	Recyling (part of)	EGSS devides recycling across 3 activities
CREMA 14. Management of minerals	-	Recyling (part of)	EGSS devides recycling across 3 activities
CREMA 15. Research and development	-	Research and development activities for natural resource management	
CREMA 16. Other natural resource management activities	-	Other natural resource management activities	

Three important observations need to be made on this table.

Firstly, the specification of the green activities that is proposed bears heavily on the recent Eurostat definition yet is divergent on a few points. Most notably it is the case for the definition of the recycling sector. The EGSS Data Collection Handbook distinguishes three activities that overlap with recycling activities. Yet it has to be noted that they are also broader than recycling. These are:

- Minimizing the intake of forest resources (CREMA 11 B)
- Minimizing the intake of fossil resources for raw materials for other use than energy …
- Management of minerals.

These three concepts all include recycling but they also include the reuse of products and in-process modifications. However, these aspects are more difficult to measure. Bioplastic bags and retreaded tyres are only a few examples of in-process modifications and reuse. The recycling component is the most readily observed one in each of the EGSS activities. Examples include recycled paper, products made of recycled wood, recycled plastic materials, recycled glass.

Secondly, the study of the Belgian Federal Planning Office makes an explicit conceptual distinction for all types of activities between:

- The production of equipment and specific materials
- The provision of services, and
- Construction and installation.

The EGSS concept and the proposed delineation of activities do not make such an explicit distinction. All three categories of activities are included in each of the defined environmental sectors.

Thirdly, while the OECD/Eurostat definition of 1999 had a distinctive category for environmental technology and equipment, the Eurostat EGSS Handbook included this activity in each of the other activities according to the activity for which the environmental technology or equipment was made or used. For instance, environmental technology exploited in equipment for use in the generation of thermal solar energy is to be included in 'CEMA 13.A. management of energy resources: renewable energy'. In the OECD/Eurostat definition, this would be included in a separate category: 'environmental technologies'. The study of the Belgian Federal Planning Office made a separate conceptual distinction as well. Yet it was concluded that "in Belgium there are no firms that are specialised in the production of equipment, technology, or materials specifically for this [cleaner technologies and products] group" (Janssen and Vandille, 2009, p.7).

Interestingly, the IDEA/Ecorys competitiveness study for the European Commission (IDEA Consult, 2009) made an explicit distinction for the environmental equipment providers as well, following the OECD definition of 1999. Technology providers were identified through representative organisations such as the European Committee of Environmental Technology Suppliers Association (EUCETSA) and the German Engineering Association (VDMA). The members of these organisations are mostly companies that are traditionally listed under manufacturing, yet a significant share of their business consists of the production of environmental equipment and solutions. This shows that, as

indicated in IDEA Consult (2009), the NACE classification of economic activities is not adapted to capture fully the new developments in the field of the environmental economy.

Other examples than environmental technology are renewable energy, air pollution control and green building. In the current NACE activity classification these companies are classified in other sectors such as manufacturing, business services, energy generation or construction. Evidently when green jobs are defined as jobs in eco-industry sectors and connected sectors, an adequate observation and delineation of the environmental activities plays an important role in the green jobs discussion as well.

Despite the various observations that can be made on identifying the *core* activities of the green economy, we believe that our definition is a workable definition that is closely related to most recent EGSS Eurostat definition, the only exception being recycling activities that have been clustered in one category, rather than being spread over three other sectors. Viewing green jobs as jobs in green sectors, this sectoral classification forms the basis for further elaboration of the green jobs concept and its connections with the underlying skills.

The list of **connected activities** in Table 5 is still exemplary in nature, based on existing literature, with the UNEP-study on green jobs being the most important reference. Again, the focus is on products and services that are green to a greater or lesser extent and not on processes. It is certainly a point for discussion which activities can be regarded as truly green and which not. We have listed those activities that provide a more environmentally alternative to the traditional products and services or contribute to the preservation of the environment.

Important to note is that the greening of the economy is a continuing process, and more activities from the 'rest of the economy' are expected to move into this category.

Table 5: Identification of green activities in the connected segment of the green economy: a few examples

Sector	Green activities
Construction	Green building: green buildings, retrofitting
Transportation	Low-emission cars
	Vehicles that run on alternative fuels e.g. hybrid cars/busses
Steel	Scrap-based production (or so-called secondary production)
	Recovery and reprocessing of slag
	Ultra-low CO^2 steelmaking
Aluminium	Scrap-based production (or so-called secondary production)
Pulp and paper	Paper collection and recycling
	Non-wood paper and pulp production
Agriculture	Organic farming
	Natural resource management e.g. water management, soil conservation efforts
Forestry	Reforestation
	Sustainable forest management
	Agroforestry
Tourism	Ecotourism

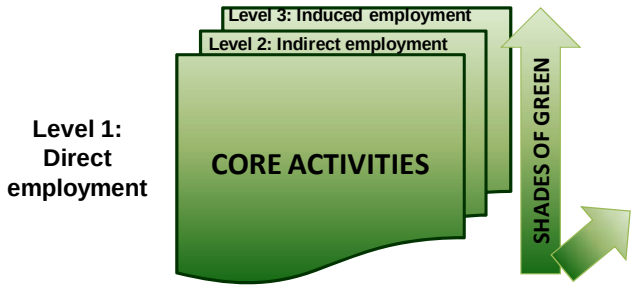
3 GREEN JOBS AND SKILLS

In the international and European debate, green jobs are directly linked with employment in the green economy, in particular with activities that make 'green' **products and services** such as the renewable energy sector or green building. Again, in political debates, green jobs are sometimes given a different interpretation, for example as jobs in a green 'work environment' or as jobs that are consist in 'greening the economy'.

Again, we start out from the activity-based approach for the same reasons as for defining the green economy as the other view points are too ambiguous.

Of course, even within the so-called green activities, not all jobs are intrinsically "green". Some jobs occur in any sector, for example support staff like administrative personnel. The skills needed for these jobs are not sector specific. Therefore, the shades of green do not only vary between different types of activities (as illustrated in Figure 2), but also within activities. Furthermore, indirect employment and induced employment also have a shade of green, that is, however, less pronounced than is the case for direct employment. These two extra dimensions are illustrated in Figure 3 for the 'core activities'.

Figure 3: Shades of green within green economy



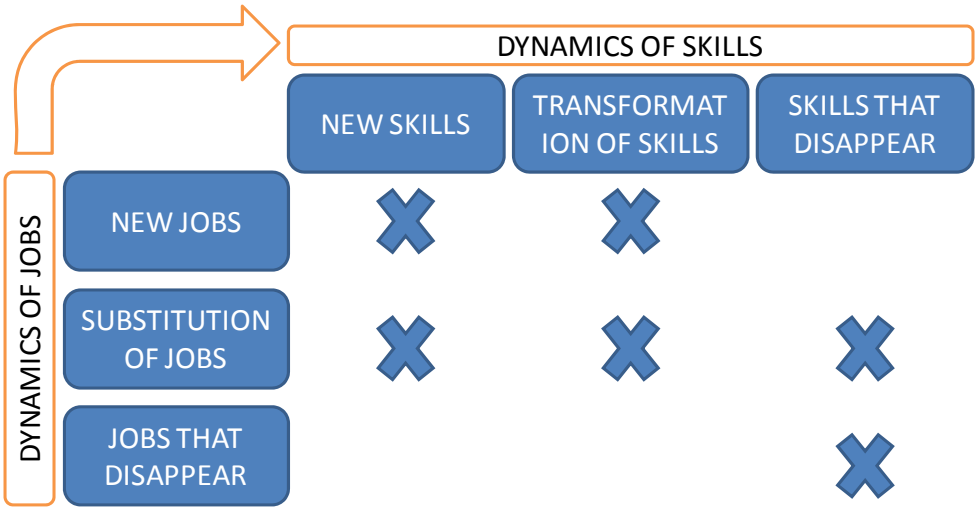
Source: IDEA Consult based on literature survey

Again, it would make the quantification of the green economy too complex if we were to try to filter out these light green or white jobs within green activities. Next to that, from a labour market policy perspective, it is vital to gain an accurate perspective of all jobs and skills needed in the 'green economy' to be able to stimulate these activities. Bottlenecks can also occur in more supportive functions and be a barrier for growth in the green economy.

So, looking at green jobs we chose the following framework to discuss several aspects of green jobs. Jobs and skills are interlinked in times of a restructuring economy, as illustrated in the following table. New 'green' activities require new and changing skills, but can also make jobs and skills in the production of traditional products and services obsolete if these new 'green' products and services take over market shares.

These skills dynamics may demand a higher qualified and better trained work force. Examples show that the jobs and skills dynamics in the green economy play on every level of education and skills and on the type of job (blue collar and white collar).

Figure 4: Dynamics of jobs and skills



Source: IDEA Consult based on literature survey

Based on international literature we can already give some examples of the existing insights in each of these topics in the following table.

Table 6: Dynamics of jobs

Dynamics of jobs	Examples
New jobs	Jobs in 'new' activities that did not previously exist e.g. recycling, wastewater management, renewable energy or the creation of jobs in growing activities e.g. insulation fitters in the construction sector
Substitution of jobs	Jobs in 'transforming' activities e.g. in the car manufacturing sector where hybrid cars are (partially) taking over from ordinary cars; research increasingly focuses on green technologies
Jobs that disappear	Jobs in 'disappearing' activities e.g. energy generation based on fossil fuels

Table 7: Dynamics of skills

Dynamics of skills	Examples
New skills	Skills in new jobs e.g. production of windmills, or skills in 'transforming activities' e.g. energy efficiency knowledge in construction sector, fitting skills for solar panel technologies
Transformation of skills	Skills in 'transforming' jobs e.g. increased level of multidisciplinary coordination skills in the construction sector, better insulation skills
Skills that disappear	Skills in 'disappearing' jobs e.g. energy generation based on fossil fuels

A major concern of the social partners and the ILO is the quality of jobs. Green jobs do not necessarily imply decent work. Decent work is defined by the ILO as "opportunities for women and men to obtain decent and productive work in conditions of freedom, equity, security and human dignity". For example, working conditions are difficult in the waste recycling sector. Green building has the same working hazards as in the rest of the building sector.

The research on the quality of green jobs is still fragmented and shows mixed results (EC, 2009).

We will further investigate two topics in this study:

- **Dynamics of jobs**: What is the proportion of direct employment in the green economy? What are the trends to be expected? Will these trends be both positive and negative? What are the characteristics of these jobs?

- **Dynamics of skills**: Which will be the skills to emerge in the 'green economy', and which will be the ones to disappear? How do they differ from existing skills? How to adapt to these evolutions in skills e.g. through education?

The case studies that will be presented in Part 4: look at the two dimensions of green jobs and the main challenges for labour market policy makers. However, before doing, this in Part 4: we look at the number of green jobs in Belgium.

Part 3: QUANTITATIVE PROFILE OF THE GREEN ECONOMY IN BELGIUM

1 QUANTITATIVE PROFILE OF THE GREEN ECONOMY IN BELGIUM

From the literature analysis, we learn that the most complete overview and detailed analysis concerning the Belgian green economy is published by the Belgian Federal Planning Bureau (FPB) in a 2009 working paper[8]. First, we explain briefly the methodology. Then, the figures from this paper are represented in Table 8, under which we sum up the main conclusions.

1.1 Methodology

This FPB paper defines the environmental industry according to the report of the OECD/Eurostat Informal Working Group (1996), quoted as follows:

> *The environmental goods and service industry consists of activities which produce goods and services to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and ecosystems.*
>
> *This includes cleaner technologies, products and services that reduce environmental risk and minimise pollution and resource use.*

Therefore, the study measures "*the number of jobs created by the environment industry as defined in a restrictive way on the basis of the purpose of the activities performed*".

The classification of the activities of the Belgian environment industry used in this FPB paper has also been taken from the OECD Manual. The detailed description is presented in ANNEX 1, as well as the conversion table we used of CPA product codes for this classification of activities.

The assignment of individual firms to the environment industry is based on an extensive list of sources and research methods:

- NACE divisions (37 recycling and 90 sewage and refuse disposal companies)
- Umbrella organisations (clusters of enterprises)
- Sectoral employers' federations
- Regional governments
- Verification of activities on the basis of the Crossroad Bank of Enterprises of the Federal Public Service "Economy", the Central Enterprises Database of Flanders of the Flemish Community, and company websites.

[8] Janssen L. & Vandille G. (2009), The Belgian environment industry (1995-2005), Federal Planning Bureau, Working paper 7-09.

- Verification of time frame of environmental activities in individual firms on the basis of the Crossroad Bank of Enterprises and the Reference Database of legal entities of the Belgian Official Gazette.

1.2 Size and development of the green economy according to FPB working paper (2009)

Evolution in employment and turnover

- Employment in environment industry has increased by 40% in the 1995-2005 period. This increase is mainly driven by the development of the specialised sector.

- Growth of employment in the environment industry is greater than growth of total employment in Belgium. Consequently, the share of employment in the environment industry increases from 1,5% in 1995 to 2% in 2005.

- Environmental turnover has increased every year, except in the years 1999 and 2005. In 2005, the environment industry experienced a decrease in turnover, while turnover in the total Belgian economy continued to grow. Consequently, the share of the environment industry in the total Belgian output dropped sharply in 2005.

Specialisation

- In terms of employment and the number of firms, the proportion of specialised producers in the environment industry increases, but in terms of turnover, their proportion decreases (and consequently that of the secondary producers increases).

Firm size

- The share in environmental turnover of the small and medium-sized firms has increased, while their share in environmental employment has decreased over time.

- As a result, in 2005, the share in environmental turnover of small and medium-sized firms was larger than their share in environmental employment.

- Also, the observed employment increase in the environmental industry is thus mainly due to an employment increase in the large firms.

Sector of activity

- The share of NACE divisions 37 and 90, which are often interpreted as the strict definition of green economy, shows that applying this definition would lead to serious underestimation of the environment industry (employment: 15%; turnover: 20%; number of firms: 34% of the environment industry).

- The NACE sector that takes up the lion's share of the environment industry is the manufacturing industry, even though in terms of number of firms,

this industry does not rank first, indicating the fact that relatively large firms are active in manufacturing.

Environmental domain

- The distribution of employment and turnover over the different environmental domains does not evolve substantially over the period 1995-2005.

- In terms of turnover, solid waste is clearly the dominant domain, whereas in terms of employment, the share of R&D, monitoring, engineering and analysis is comparable to the one of solid waste. This indicates that the latter domain is relatively labour-intensive.

- Moreover, the domain of R&D, monitoring, engineering and analysis is responsible for about half of the employment at secondary producers, whereas employment at the specialised producers is more divided over different domains (solid waste; wastewater; R&D, monitoring, engineering and analysis; air pollution control).

- The share of air pollution and indoor pollution control was more than twice as large as its share in the number of firms, which leads to the conclusion that this activity is performed in relatively large firms.

Goods and services

- The share of firms that produce environmental goods or install environmental equipment is considerably higher in terms of turnover and employment, than in terms of number of firms. This means that producers of goods are on average larger than those delivering services in the environmental field.

- A shift towards services is observed over the period 1995-2005, especially in terms of turnover, but also in terms of employment.

1.3 Conclusion

Our concept and the FBP definition are relatively closely linked, the only difference being that our definition includes a number of environmental sub-sectors that have not been taken into account explicitly in the FPB study. From this point of view, the FPB study provides a view on a minimum border line. Conceptually the FPB study identified firms on the basis of their primary and secondary environmental production goals. In this sense, it captured both the core and the connected environmental activities. It is as yet the most complete estimate of the Belgian green sectors. Based on the FPB results, one can see that the environmental economy is growing over time, accounting for two percent of total employment in 2005. The FPB study found that almost half of the Belgian environmental enterprises were present in solid waste management. 30% of environmental employment was generated by firms in the connected industry of manufacturing. Research and development, monitoring, engineering and analysis was found to be the most labour-intensive environmental activity.

Table 8: Figures of the green economy and employment in Belgium

The environmental industry	2005			average 1995-2005		
	FTEs	number of firms	turnover	FTEs	number of firms	turnover
Overview						
Total	77.000	2.375	14,4 bio euros	66.000	2.538	12,1 bio euros
Share in total Belgian economy	2,0%		2,2%	1,8%		
Specialised producers[9]	*63,0%*	*70,4%*	*66,0%*	*60,5%*	*71,7%*	*67,5%*
Secondary producers[10]	*37,0%*	*29,6%*	*34,0%*	*39,5%*	*28,3%*	*32,5%*
Firm size						
1 to 9 FTEs	5,0%	62,0%		5,0%	60,0%	
10 to 99 FTEs	27,0%	31,0%		28,5%	30,0%	
> 100 FTEs	68,0%	7,0%		66,5%	7,0%	
Sector of activity (nace)						
Agriculture, forestry, fisheries, mining and quarrying (A-C)				0%	3%	0%
Manufacturing (D ex 37)				27%	11%	40%
Recycling (37)				3%	13%	7%
Electricity, gas and water supply (E)				4%	1%	4%
Construction (F)				10%	8%	7%
Wholesale and retail trade (G ex 51.57)				3%	8%	6%
Wholesale trade in waste and scrap (51.57)				1%	3%	2%
Transport, storage and communication, financial intermediation, real estate, renting and business activities (I-K ex 74)				5%	5%	3%

9 Organisations for which the production of environmental goods and services is the principal activity are called specialised producers.

10 Organisations for which the production of environmental goods and services is not their main activity are called secondary producers.

Other business activities (74)				14%	17%	11%
Public administration (L)				17%	6%	6%
Education, health and social work, other service activities (M-Q ex 90)				4%	4%	1%
Sewage and refuse disposal, sanitation and similar activities (90)				12%	21%	13%
Environmental field						
Air	8,0%		7,0%	8,5%	4,0%	6,5%
Wastewater	15,0%		15,0%	15,0%	17,0%	16,5%
Solid waste	36,0%		47,0%	35,0%	48,0%	49,0%
Soil	3,0%		4,0%	2,5%	5,0%	3,0%
Noise and vibration	2,0%		2,0%	2,0%	2,0%	2,0%
R&D, monitoring, engineering and analysis	30,0%		19,0%	31,5%	18,0%	17,5%
Rational energy use	5,0%		4,0%	4,5%	5,0%	4,0%
Sustainable forestry, agriculture and fishery	1,0%		1,0%	1,0%	1,0%	1,0%
Goods and services						
Goods and installation	21,0%		23,0%	22,5%	14,0%	27,5%
Services	79,0%		77,0%	77,5%	86,0%	72,5%

Source: Janssen L. & Vandille G. (2009), The Belgian environment industry (1995-2005), Federal Planning Bureau, Working paper 7-09.

Part 4: SECTOR CASES

1 INTRODUCTION

The purpose of the sector cases is to gain a clearer insight into how the 'green economy' functions. In particular, the following questions will focus on:

- What are the characteristics and drivers of the green economy?
- How does the 'green economy' affect jobs and skills?
- How can labour market and education policy support the green economy?

Two sectors have been selected, namely the renewable energy sector and green building, for the following reasons:

- These sectors meet the strict **definition of green economy** and provide an example of each type of activity, i.e. core and connected activity.
- Climate change is high on the European political agenda and both sectors undergo a **major influence of climate policy**: the construction sector directly via the Energy Performance of Buildings Directive (EPBD) and the renewable energy sector directly via the Directive on the promotion of the use of energy from renewable sources and indirectly via major campaigns to promote renewable energy.
- The construction sector is one of the largest industrial sectors in Europe. A study by the Belgian Federal Planning Bureau indicates that on average over the period 1995-2005, 8% of all firms in environmental industries are active in construction, which amounts to 7% of environmental turnover and 10% of environmental employment[11].
- The renewable energy sector is still in its growth phase but is expected to strengthen its position in the future.

The sector cases are based on both literature and interviews. Documents and surveys which are available in Belgium have been used and have provided information about context and employment. However, interviews with sector representatives, companies and educational institutions were necessary to acquire a more in-depth view of the impact of policy on the sector, the dynamics in jobs and skills and the labour market challenges. The next table gives an overview of the persons that have been interviewed.

[11] Janssen L. & Vandille G. (2009), The Belgian environment industry (1995-2005), Federal Planning Bureau, Working paper 7-09.

Table 9: Overview of the interviewees in the sector cases

Sector		Organisation
Green building	Sector	Vlaamse Confederatie Bouw (Flanders)
		Confédération de la construction (Walloon region)
	Companies (Flanders)	Aclargo
		Bostoen
		Elektro Decat
		Wycor
		Van Roey
		Independent architect
	Training & education	Fonds voor vakopleiding in de bouw (Flanders)
		VDAB (Flanders)
		Cevora (Flanders)
		Syntra (Flanders)
		Ouvriers CP124 (Walloon region)
		AID Tubize (Walloon region)
	Others	Cluster Green building de Wallonie (Walloon region)
		Cluster CAP 2020 (Walloon region)
		PMP Plate-Forme Maison Passive (Brussels and Walloon region)
		Centre Urbain de Bruxelles (Brussels)
Renewable energy	Sector or associations	Agoria (Walloon region)
		Compagnons d'Eole (Walloon region)
		Valbiom (Walloon region)
	Others	Cogensud (Walloon region)
		Cluster ER-URE (Walloon region)
		Energy Facteur 4 (Walloon region)
		Service Public de Wallonie (Walloon region)
		Institut Bruxelloise pour l'Environnement (Brussels)

2 GREEN BUILDING

From recent EU studies, we learn that the construction sector is the biggest industrial employer and that it is responsible for 42% of total energy consumption and 35% of all greenhouse gas emissions[12]. What these general figures make clear is that the construction industry is of major importance for the economy and for the environment. In the words of the Belgian Building Confederation[13]: *"The construction industry is at the same time a problem and a solution for sustainable development"*. The industry is a large-scale energy consumer but at the same time holds the key to considerable energy savings by opting for green building.

Belgium was one of the first countries to implement the Energy Performance of Buildings Directives, and also the sector sees many opportunities in contributing to a better environment: integrated water policy, soil sanitation, sustainable use of space, recycling of building and demolition waste, energy saving construction etc. In this case study, we examine in greater detail the characteristics of green building and the challenges it brings for the labour market. We also look at the contextual factors that influence the development of green building.

2.1 Definition of green building

The general concept of **sustainable construction** seeks to integrate sustainable development objectives in construction activities. It embraces environmental concerns (e.g. natural resource efficiency), user health (e.g. indoor air quality) and social issues (e.g. independence in old age).

Strictly speaking, **green building** is a part of sustainable construction. More specifically, it focuses on the *environmental dimension* by reducing the requirements in natural resources (energy, but also water and land, use of renewable materials etc) and the overall environmental impact of buildings and infrastructure. It does so in all phases of the construction process, from design to demolition and recycling. The impact of the building during its lifetime, including energy demand (e.g. insulation, passive buildings), energy generation (e.g. solar panels, solar thermal energy…) and water usage (e.g. re-use of rain water…), is thus very important in the definition of green building. This life-cycle view implies the assessment of the raw material production, manufacture, distribution, use and disposal including all transportation.

In short, green building covers a variety of areas such as recycled materials, renewable energy generation and water usage. It is not a core green sector but it is a **connected industry** in which activities are executed in a way that has a substantial (positive) impact on the environment without this being the first objective. It is also a sub-sector of the construction industry that in the current version of the NACE activity classfication cannot be separately identified. In principle, all construction firms can potentially engage in green building and this in various degrees.

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12 http://ec.europa.eu/enterprise/policies/innovation/policy/lead-market-initiative/sustainable-construction/index_en.htm

13 Belgian Building Confederation (2008), Annual report 2007, Brussels.

2.2 Importance of green building

Green building techniques can be applied to any scale of construction and in principle any construction company can be engaged in it, so all 80,802 companies in Belgium are potential green building companies. Employment specific to the green building sector can be expected to be much lower, especially if only the parts of the buildings with a high environmental performance are taken into account. Furthermore, most companies and thus also their employees are engaged in a mix of green building and conventional construction.

A number of studies estimated the **specific share of green building in Belgium**. A survey among members of the Belgian Building Confederation (2008)[14] indicates that **70% of the firms** are to some extent active in green building, mainly in terms of thermal super-insulation, processing of waste, sound insulation, use of renewable materials and installations for heating and ventilation. Table 10 shows the importance of the different ecological activities of these firms.

The survey results in Table 11 also show that most firms have been engaged in green building since 2000 or earlier, and that they have experienced a light to strong growth in these activities since 2004. The growth has been strongest in companies specialized in installing activities[15].

Furthermore, the sectoral federation confirmed an increasing demand for more energy-efficient houses and buildings in diverse segments (residential sector, schools, offices) and more investments in the generation of renewable energy. Financial reasons and greater awareness of climate change are encouraging some people to go beyond the legal standards.

A trend that is observed at European level is one of traditional building companies **diversifying** their product range to include green building products. The main players (according to their 2007 operating revenue) in the European market, however, often combine green building with other industrial activities (which is a typical trend in the category of connected activities). For example, the German firm Umicore AG is a leading supplier of precious metals with an expertise in materials science, chemistry and metallurgy. Others, like Wienerberger in Belgium, enter the sustainable building market segment from their construction products activities. Given this, the market of pure green building is characterised by small national niche players[16].This growing interest in diversification also emerged from the survey on green building among the members of the Belgian sectoral federation in 2008.

[14] Belgian Building Confederation (2008), Annual report 2007, Brussels.

[15] IDEA Consult (2008), Survey sustainable construction: results, Brussels.

[16] IDEA Consult (2009), Study on the Competitiveness of the EU eco-industry, Brussels.

Table 10: Which aspects of green building are part of the activities of your company? (multiple answers possible)

Answer	Total	Percentage of answers	%
Thermic super-insulation of floors, walls, roofs, windows…	591		62 %
Acoustic confort (acoustic insulation of floors, walls, roofs, windows…)	329		35 %
Use of renewable raw materials (certified woord, recyclable or recycled material, rain water…)	326		34 %
Processing or reuse of waste products (seperated types of waste on the construction site, recycling of materials, treatment of water…)	321		34 %
Super energy efficient equipment (heating, ventilation, warm water, lighting)	302		32 %
Safety in buildings	235		25 %
Reduction of maintenance costs	222		23 %
Alternative energy (solar energy, wind energy, geothermal energy…)	193		20 %
Adaptation to needs of disabled persons (accessibility, sanitary fittings…)	147		15 %
Air quality (use of materials without solvents, air purfication…)	138		14 %
Modular construction	33		3 %
Others	55		6 %
Total number of answars: 952		0 % 20 % 40 % 60 % 80 %	

Source: IDEA Consult (2008), Survey sustainable construction: results.

Table 11: Since 2004 the share of ecological activities has…

Answer	Total	Procent of answers	%
-1 decreased	2		0 %
0 remained constant	136		15 %
1 slightly increased	293		32 %
2 strongly increased	312		34 %
3 very strongly increased	75		8 %
4 no opinion	93		10 %
Total number of answers: 911		**0 % 20 % 40 % 60 % 80 %**	
Average score		**1,39**	

Source: IDEA Consult (2008), Survey sustainable construction: results.

2.3 General characteristics and trends

Because the majority of companies are engaged to some extent in green building, the main characteristics of the sector also apply (more or less) to the green building subsector.

In Belgium, the construction industry has a **turnover** of 47.7 billion euros (of which 66% in Flanders, 22% in the Walloon region and 12% in Brussels). 80,802 companies were counted as **building companies** in 2008 (of which 63% in Flanders, 28% in the Walloon Region and 9% in Brussels)[17].

2.3.1 Scale and activities

The **scale** of the construction companies is proportional to the scale of the building projects they work on, so there is diversity in the size and type of companies. Yet, overall, the sector consists mainly of small firms. In Belgium, two thirds of all firms in 2008 are self-employed, and another 21% has 1 to 4 employees. Only 1% of the firms employ more than 50 people[18]. The bulk of small companies are active mainly in small construction works in the residential market. Medium-sized companies mainly dominate the non-residential / office buildings market and large companies are the only ones capable of building large infrastructure projects.

[17] http://www.confederatiebouw.be/files/annual_report/Kerncijfers%202008.pdf

[18] Belgian Building Confederation, based on RSZ and RSVZ figures.

2.3.2 *Internationalisation and competition*

When we look at the **global context** in which the Belgian green building industry operates, we see that the leading European green building markets are Germany, Austria, the Netherlands and the Scandinavian countries. Outside Europe, Asian countries like Japan and China are also important players, but they focus mainly on cost reductions in production rather than on the development of radical new products. In the US, ecological building is initiated as well but it still has a strong ideological connotation with alternative ways of living.

The market is very much fragmented across and within EU Member States. Activities are to a large extent **locally oriented**, especially those in relatively small firms. The large building companies are (highly) **international** as there is a global export market for large scale building and infrastructure projects. Construction is a global industry with generally weak legal barriers to trade and investment.

Competition is intense and mainly based on cost and price considerations. Yet, in recent years a transition towards a value-driven market, however slow, is observed. This means that producers compete on the basis of the value of their products and that the market is prepared to pay more for high value products[19]. This context enables the evolution towards niche markets with high value or more complex green products.

2.3.3 *Innovation*

In general, technological change is slow. The two main areas of **innovation** in green building are products/processes and the supply chain. The latter focuses on the adoption of a service-oriented approach that is extended to the use, upgrading and retrofitting of buildings/infrastructure. There is also an increasing degree of cross-sectoral innovation, e.g. for the integration of renewable energy technologies in building components. **R&D** is mostly carried out at universities across Europe, as well as in large industrial companies. Besides this, the **implementation** of all this knowledge and know-how in the building companies themselves and in the adoption of these new techniques by the market is progressing slowly. This is also due to the bulk of small firms who often lack the highly skilled workers and capital to implement new techniques[20].

Because of the tendency towards **automation**, activities that are traditionally carried out on the construction site are being pooled in a workshop or factory so that economies of scale can be exploited. The controlled environment also makes these activities independent from weather conditions. This tendency appears to be particularly relevant for the green building section of the industry since

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[19] Eichholtz, Piet, Kok, Niels and Quigley, John (2008) Doing Well by Doing Good? Green Office Buildings.
This research by Eichholtz, Kok and Quigley from the Universities of Maastricht and Berkeley compared rents and selling prices of green office buildings (Energy-Star and LEED-rated) with conventional office buildings in the United States. They conclude that, on average, certified green office buildings reached higher selling prices and rents than conventionally-built ones. Rents for green offices were roughly 2 % higher than rents for comparable buildings located nearby. Effective rents (i.e. rents adjusted for the occupancy levels in office buildings) were found to be 6 - 9 % higher. The selling prices of green office buildings were found to be about 16 % higher than other nearby buildings.

[20] The European figures and trends in this chapter are based on IDEA Consult (2009).

building components with high environmental performance rely strongly on accurate and precise assembling with little room for tolerance.

Another evolution we mention here is the cooperation between and **integration of the renewable energy sector and the green building sector** in the field of technological change. The integration of renewable energy technologies in building components is a particularly promising area. In European countries, this is still an early-stage process, but in Japan renewable energy companies have acquired construction companies and offer construction material with integrated renewable energy components.

2.4 Drivers for green building

There are three types of factors that influence the demand for green building:

1. **Minimum standards** e.g. minimum E-level[21] (EBPD), standards
2. **Financial costs and benefits** e.g. price of raw materials, investment costs in energy-efficiency, collectivizing of construction projects
3. **Awareness** e.g. more attention on climate change and other environmental issues

Policy makes use of different instruments to play along with these different factors: (1) regulation, (2) fiscal stimuli and (3) awareness-raising campaigns.

The 2008 survey on green building among members of the sector confirms these drivers. The next table shows the scale of importance.

Table 12: What influence do the following elements have in the evolution towards more ecological construction?

Rank	Elements	Score
1	Level of premiums and tax deduction	4,13
2	Media attention and promotion	4,00
3	Interest of clients in green building	3,89
4	Regulation	3,70
5	Knowledge of clients of available ecological materials and techniques	3,65
6	Involvement of the building contractor in the conceptual phase	3,65
7	Offer of sustainable building materials and techniques	3,63
8	Transparency in support measures	3,58

[21] The E-level expresses how a building performs in term of energy use. The lower the E-level, the better.

9	Knowledge of building contractors of ecological materials and techniques	3,54
10	Offer of building contractors engaged in green building	3,45
11	Cost price of green building	2,86

Source: IDEA Consult (2008), Survey sustainable construction: results.

2.4.1 Regulation

Governments across Europe have played an important role in making ecological building more 'mainstream'. Subsidies have been and are still a frequently used instrument to accelerate the use of sustainable building techniques. However, this has been done not only at Member-State at Belgian level, but also on a regional level. The result is diversity in regulation and a frequent mismatch of building standards and codes in the EU. Consequently, the administrative burden is considerable and, given that the business structure is predominantly local, the green building market is extremely fragmented. Also, national building and planning standards and differences in validated and approved techniques are a barrier to the introduction of innovative (e.g. new types of cement with enhanced environmental performance) or alternative building materials and methods.

The **Energy Performance of Buildings Directive** (2002/91/EC) is the most important piece of European legislation for the green building sector. It concerns the residential sector and the tertiary sector (offices, public buildings, etc.) and stipulates:

- A general framework for a methodology to calculate the energy performance of buildings,
- The application of minimum requirements on the energy performance of buildings,
- The energy certification of buildings, and
- A regime of boiler inspections at regular intervals and, in addition, an assessment of the heating installations with boilers of more than 15 years of age.

Member States shall apply a methodology, at national or regional level, to be used for the calculation of the energy performance. Hereby it is acknowledged that there are major differences among the Member States with regard to the building stock and construction works which have an impact on the state and the evolution of energy efficiency. One of the objectives of the recasting of the EPBD (2009) is to reduce national differences and – in the long run – to develop a common system for the assessment of energy efficiency. However, the draft of the Directive mentions a comparative methodology which implicitly means that, in future, national differences will be accepted. A more recent investigation in the possibilities to harmonize energy performance assessment procedures indicates that, even between countries which share a similar climate, there are considerable differences in the building stock. It will therefore be difficult to compare energy performance.

The **Construction Products Directive** (89/106/EEC), which applies to any products made for permanent integration in construction works, sets out a number of essential requirements in terms of working life, mechanical strength and stability, fire safety, hygiene, health and environment, safety in use, noise protection, energy economy and heat retention. The Directive established the framework in which the European construction industry has been operating since 1989. The main elements are:

- Harmonised European standards for construction products adopted by the European standardisation bodies (CEN and/or CENELEC);
- A system of European technical approvals to assess the suitability of a construction product in cases where there is no harmonised standard and a standard cannot or cannot yet be prepared;
- The European Organisation of Technical Approvals (EOTA), which groups together the national approval bodies, is responsible for drawing up the technical approval guidelines.

To further enhance the internal market for construction, the European Commission presented in May 2008 a proposal to replace the Construction Products Directive with a new Regulation aimed at removing the remaining regulatory and technical obstacles to the free circulation of construction products in the EU. The new Regulation introduces standards at EU level which will replace the myriad of national standards. Implicitly it also introduces a common terminology, which is important in this new field of development. The new Regulation introduces the aspect of durability in addition to the other six essential features with which all buildings in the EU have to comply.

Furthermore, every Member State has building and planning regulations that affects the scope for green building. In the Member States with a federal structure, competence for building regulation is frequently extended to sub-national levels, as is the case in Belgium. The legal competence for planning regulation is usually at regional or local level.

The directives are translated into regional policy and are as a result differently implemented in Flanders, Brussels and Wallonia. Next to that, the regions also decide how to promote green building e.g. premiums which can have a different level or different requirements.

2.4.2 Standards

The construction industry is in general not in favour of standards or quality labels, especially not environment-related labels. However, environment-related labels do provide relevant data to customers that are increasingly looking for such information. At the international level, the Environmental Product Declaration (EPD) system exists. This system helps organisations to communicate the environmental performance of their products (goods and services) in a credible and understandable way. It is a voluntary system that firms can apply for. The EPD does not make any explicit evaluation of the environmental performance. In that sense it is very different from the Natureplus label, which evaluates building materials according to their environmental friendliness and positive health effects. This label gives customers the guarantee that a building material is produced according to a number of minimum requirements in terms of environmental sustainability.

In terms of testing building materials (for fire safety etc), this has been organised at national level, meaning that different tests need to be carried out if a material is to be sold in different countries. At the present time, work is being done to harmonise these testing systems and make it possible for tests to be recognised across Europe.

Given the above, it is not surprising that the green building sector is still lacking a "common language" which largely refers to the absence of EU-wide technical standards behind concepts like "passive house", "zero-energy building" or "low-energy house". Standardisation measures can improve the situation and introduce concepts relevant for the further development of green building. This could include:

- Framework, assessment methods and benchmarks for sustainability performances of buildings and supply chain;
- Integration of sustainability aspects in construction design standards (Eurocodes);
- Sustainability criteria and technical assessment of innovative construction products (Construction Product Regulation).

2.4.3 Economic triggers

Financial costs and benefits also play a major role in investment decisions. Total costs and cost recovery delays are important.

2.4.3.1 Rising prices of raw materials and energy

The growing scarcity in raw materials, energy and space results in rising prices for these commodities. It makes investments in energy efficiency, recycling of materials and the production of renewable energy more interesting because of higher benefits compared to the costs. The sector illustrates this trend by saying that new buildings have evolved automatically to an E85-level, whereas an E100-level is the legal minimum[22].

2.4.3.2 Decreasing prices of materials used in green building

Because of the increasing production in materials used in green building for instance solar panels and condensation boilers, the price of these commodities has decreased. This means that a larger number of consumers gets financial access to these products.

2.4.3.3 Financial incentives

Financial incentives given by policymakers cause a decrease in the investment costs and hence a rise in cost-effectiveness. Different initiatives exist:

- Subsidies granted by the government (e.g. project subsidies for photovoltaic installations)
- Fiscal incentives (e.g. federal tax deduction of investments in insulation)

[22] VCB (2009), VCB waarschuwt voor eco-Kafkaiaanse rompslomp: Overheid met maximaal groene bouweconomie laten spelen, Brussel.

- Premiums and actions of network administrations (e.g. for insulation, replacement of single-glazing, replacement of boilers)

Also within the public administration, measures are taken to stimulate investments in energy-efficient buildings. For example, the investment programme for schools requires a minimum E-level of 70 to be taken into account for subsidies.

Research shows that especially higher income categories take advantage of such financial stimuli because they have no problems with pre-financing the investments[23]. Therefore, a number of funds have been set up:

- The (federal) Fund for the Reduction of the Global Energy Bill (Fonds voor de Reductie van de Globale Energiefactuur (FRGE)) that offers cheap loans that are more favourable than normal market conditions;
- The National Gas Fund received a once-only amount from the former Controlling Committee that can be used to grant premiums for energy savings.

2.4.3.4 Collectivisation of construction projects

More and more construction projects are collectivized in e.g. climate neigbourhoods. Collective investment in heating equipment, for instance, ensures that the investment costs are divided over multiple users[24].

2.4.4 Environmental concerns

Finally, awareness regarding environmental and climatic issues has also stimulated demand for green building. The awareness-raising campaigns of the government play a reinforcing role, both for private investors and for the public sector[25]. Some initiatives have been set up on different political levels:

- at European level, e.g. Concerto, Intelligent Cities
- in Flanders, e.g. Vlaanderen in Actie, Noordzeering
- at municipal level, e.g. climate neighborhoods[26]

From the demand side, increasing awareness is leading to an increasing demand for environmentally friendly buildings, and large potential lies in retrofitting the existing building stock according to modern standards. Moreover, demand will be further stimulated towards green buildings as it will probably also become compulsory to build in a more sustainable way (and thus to minimize waste and energy, to conserve water and enhance bio-diversity).

[23] VCB (2009), Jaar- en studierapport 2008/2009 'Bouwen aan milieu en energie: Elementen voor een groene bouweconomie', Brussel.

[24] IDEA Consult based on interviews with sector and companies.

[25] IDEA Consult based on interviews with sector and companies.

[26] 'Klimaatwijken' ('Climate Neighbourhoods) is a campaign developed by the 'Bond Beter Leefmilieu' (BBL). The project is run in cooperation with Dialoog, Ecolife, the Flemish provinces, the network managers and the participating municipalities. A climate neighbourhoo is a group of around 15 families that takes on the challenge of saving eight percent of energy at home during six months (http://www.bondbeterleefmilieu.be).

2.5 Jobs and skills

2.5.1 Employment characteristics of the construction sector

Like construction in general, green building is highly **labour intensive**. Personnel costs typically represent about 70% of the total construction cost, and the remaining 30% are largely attributable to material acquisition. In Belgium, 57,964 people were working with a self-employed status in the construction sector in 2008. For 64% of these people, construction was the main activity, and 15% of the self-employed were helpers on-site. 210,272 people were employed in construction firms (excl. the self-employed)[27].

The focus on assembling activities involves a high input of **manual labour**. When a firm is international, the manual construction work is carried out on-site by employees from the country of the building site. A limited number of management and inspection jobs are carried out on-site by citizens from the exporting country. The highly skilled architectural and engineering work is normally carried out in the country where the exporting firm is based.

However, **automation** and the use of larger pre-fabricated components are becoming increasingly important, due to increases in economies of scale and the control of working conditions (e.g. weather) in workshops and factories as compared to building sites. This tendency appears to be particularly relevant for the green building section of the industry since building components with high environmental performance rely strongly on accurate and precise assembling with little room for tolerance.

2.5.2 Employment in green building

Measuring the job dynamics in green building is not an easy exercise based on the available employment statistics.

The Flemish Building Confederation estimated that the policy framework for the improvement of investments in water treatment, soil sanitation, recycling of construction and demolition waste and energy savings has lead to an extra 8,250 direct jobs in construction companies specialized in each of these activities. This number is based on different sources: investments in water sanitation, number of recycling installations, company federation of soil sanitation, etc. (VCB, 'Studierapport 2008-2009: Bouwen aan milieu en energie', 2009)

The sector expects this amount of additional 'eco'-jobs to rise to 24,100 jobs in 2020, of which 11,500 in energy-related investments and 3,300 in the maintenance of buildings. These figures are based on assumptions related to trends in investments and technological changes (e.g. in recycling).

However, the sector admits these figures are somewhat underestimated as investments in schools and offices as well as in retrofitting are not taken into account.

The numbers should therefore be interpreted very cautiously. As already mentioned, 70% of the companies say they are involved in green building but still

[27] Belgian Building Confederation, based on RSZ and RSVZ figures.

have conventional construction activities too. Next to that, the economic crisis also had an impact and slowed down the market growth of recycling materials and soil sanitation.

2.5.3 Dynamics in jobs

The shift towards green building with more attention of energy and environmental performance and a rising use of ecological materials and techniques has effects on jobs and competences.

We make a distinction between two types of dynamics:

- **Volume**: Some jobs are more important than in the past while others receive less attention or even disappear. Sometimes, new occupations arise due to specialization or to the need for totally new competences.

- **Content**: Occupations can also change in terms of job responsibilities or competences (which is a mix of knowledge, skills and attitudes).

Content changes in jobs are more frequent than volume effects. The emergence or disappearance of occupations starts with changes in the current job and its responsibilities. An existing occupation disappears when the specific responsibilities in that occupation do. The executer develops as an all-rounder or specializes in other activities. A new occupation starts with new responsibilities within an existing occupation, after which the executer specializes in these new tasks. These changes in turn have an effect on the competences needed.

2.5.3.1 Dynamics in volume

In each phase of the construction process including design, contracting, execution and finally administration, shifts in jobs appear:

- **New jobs become needed,** e.g. energy experts

- **Jobs grow in importance,** e.g. fitter of solar panels

- **Jobs lose importance,** e.g. fitter of air conditioning

Several dynamics can underlie volume increases:

- Changes in legislation and the need for more coordination create new occupations on top of the existing demand, both specialist jobs like energy experts as well as more administrative personnel and engineers to keep up with administrative and legal work related to norms and the corresponding reporting obligations.

- For some existing occupations, a shift in focus leads labour demand in this occupation to increase (e.g. fitters of reflective systems). For some existing occupations, the occupation is deployed in (new) ecological applications e.g. fitters of geothermic sinking augers for vertical heater exchangers; because of the growing success of heat pumps this occupation is gaining a new dimension[28].

[28] IDEA Consult based on interviews with sector and companies.

Table 13: Dynamics of occupation

Type of change	Segment	Occupation
New occupations	Services	Energy expert
		EBPD-reporter
		Thermograph[29]
	House construction	Airtight constructor
		Construction coordinator
Occupations that grow in importance	Services	Engineer specialized in ecological technologies
		Administrative personnel and engineers for follow-up regulation and reporting
	Industrial construction	Fitter and maintenance engineer for installations of wind energy
	House construction	Fitter of green roofs
		Fitter of reflective systems
		Insulator and post-insulator
		Fitter of photovoltaic solar panels and solar boilers
		Fitters of geothermic sinking augers for vertical heat exchangers
		Fitter of heating systems with wood pellets
		Fitter of power-heat coupling
		Fitter of ventilation systems
Occupations that lose importance	House construction	Fitter of air-conditioning systems
		Fitter of electrical heating

Source: IDEA Consult based on interviews

It is important to indicate here that the job classification is not always clear in practice. An architect can also be an energy expert; a fitter can install both heating systems and air-conditioning systems. Insulation is also incorporated into the responsibilities of the bricklayer, roofer, plasterer and carpenter[30]. Especially for self-employed carpenters or plasterers, insulation is one of the tasks to be performed and is growing in importance.

[29] Thermography is a technique to identify heat losses in buildings due to construction, insulation, window defects etc.

[30] SERV (2009), Competences profile of the 'Insulator carcass/roof' profession, Brussels.

2.5.3.2 Changes in tasks and competences

Next to changing responsibilities, changing materials and technologies can also have an impact on the content of an occupation, independently of whether that occupation grows in importance or not. For example, within the central heating subsector, there is a shift from traditional boilers (using fuel oil) towards high efficiency boilers (that burn natural gas). This does not mean that the occupation of the central heating technician changes completely: often traditional and new activities are combined in one job.

To conclude, we observe the following types of dynamics:

- **New occupation,** e.g. energy expert
- **Occupations that change in tasks and competences,** e.g. central heating technician

On every level and in each occupation changes are observed, influenced by increasing regulations (e.g. energy performance) but also the changing materials and technologies. The table below gives an exploratory overview of the changing tasks and competences based on interviews with the sector and companies.

Table 14: Change in tasks and competences in the construction sector

Construction phase	Occupation	Change in tasks and competences
Design	Architect	The building legislation and the influx of new materials and techniques require a lot of **extra preparation work** and **additional training needs**. Within the framework of the energy performance of buildings Directive, specific knowledge is needed in order to assess the energy performance, identify the necessary techniques and materials, and report to the administration by using the appropriate software. **Modular construction** of cooling, ventilation, heating and hot water grows in importance. This was already required in large construction projects but now also finds acceptance in the residential sector. There is an increasing need for **interdisciplinary cooperation**. In smaller projects the architect also coordinates the construction process; hence the coordination tasks become more important. There is increasing **communication** with contractors and executors to monitor the effects of the design, for instance in terms of energy performance. In relation to the client, the architect plays an important **advisory role** concerning green building.
	Engineer	As the architect faces a rise in complexity in his/her tasks, there is a growing use of the expertise of engineers that are specialized in green building techniques.

Contracting	Contractor	In large projects, the contractor is the main coordinator of the execution of the plans. The modular construction and interdisciplinary cooperation increase the complexity of the **coordination tasks**. Because of the new advanced techniques and products, there is increased use of specialist subcontractors, especially in large projects e.g. for cold and warmth storage or solar panels. A **broad market view** is necessary to secure the right contacts in finding the subcontractors. The changing products and techniques require adequate **technical training**. For example, in low energy buildings, more and more timber frame construction is used, which requires a different type of construction that the conventional one.
	Construction coordinator	The increased complexity of the coordination tasks has lead to a new occupation: the construction coordinator, who takes over these tasks from the architect and contractor. Often they have previously worked as a contractor, architect of interior designer.
Execution	General	A good knowledge of **construction physics** is necessary to understand the functioning of insulation and waterproof layers, to have an understanding of the water/fluid balance of buildings etc. **Accurate execution** of the tasks is of vital importance to avoid heat losses and inadequate insulation because the consequences can be very negative. The impact of mistakes is larger than it used to be, especially with passive houses, but also with retrofitting. Every subcontractor needs to be aware of this as practice shows that the replacement of insulation and waterproof layers are not always precisely put back in place. To upgrade the quality of the work, some construction companies choose to let their employees **specialize**. They have fewer tasks to do but are given more responsibility in executing them. In this way new jobs like that of airtight constructor are created. As legislation become more stringent and new products and techniques are introduced, there is a constant need for **training**.
	Central heating and sanitary technician	There is a growing need for **technological knowledge** due to the growing use of computer systems and the complexity of new products. New technical systems like solar boilers, heat pumps, hybrid systems, and micro-WPC demand **specialization**. Next to that, ventilation is also fitted by plumbers.
	Insulator	If no architect is involved in the building process, the insulator needs to carry out a pre-study to avoid badly positioned and incomplete insulation. This study requires a lot of **specialized knowledge** about insulation possibilities, dew points, tracing cold bridges, water/fluid balance etc.

Electrician	Often, electricians are trained to install **solar panels**. An extra aspect that is introduced in their job is **safety on roofs**. There is an increased specialization in **home electronics** in function of the rationalization of energy use, e.g. programming the lighting system, intelligent control of a technical installation etc.
Roofer	Roofers are involved in the construction of green roofs and the fitting of renewable energy systems like solar panels or roofing materials with integrated photovoltaic cells.

Source: IDEA Consult based on interviews

The sector expects that, because of the rising complexity, highly and medium educated jobs will become more important compared to jobs with low qualifications but the latter will nonetheless remain important.

2.5.4 Training needs

The previous sector clearly indicated a need for training in the diverse occupations and construction phases. Also, the results of the 2008 survey on green building among the members of the Belgian construction sector showed training needs on the administrative, technical and practical level.

A survey of the Flemish sectoral federation in 2010 in relation to the Energy Performance of Buildings Directive made these needs a little more concrete. 57% of the companies expect that if regulations become more stringent, training will be needed to adapt to different construction methods and changing techniques. The most important domains are:

- Ventilation
- Insulation
- Air tightness
- Building structure

The needs are mainly situated at the level of management and workers. According to the sector, training should be adapted and developed in cooperation with other partners, for example higher education institutions.

Existing training has been adapted to new techniques and supplemented with extra modules concerning energy performance regulation. This is often done in partnership with the sector.

The next paragraphs describe the activities in the different regions, as education is a regional competence (like employment).

2.5.4.1 Flanders

New training programmes have been initiated for different target groups:

- A semestrial training course for 'Energy Coordinators' developed by the Association KU Leuven and various higher education institutes, targeted at architects, contractors…
- A modular training course on 'Green Building' with topics such as green roofs, ventilation etc. developed by Cevora together with the Flemish Building Confederation, targeted at white-collar workers.
- A modular training course on 'Low-Energy Living' with topics like condensation boilers, heat pumps, solar energy, EPBD and consequences for the building site, and 'from a low-energy house to a passive house', developed by Edutec[31] and targeted at blue-collar workers in the sector and students in construction.
- The promotion of a professional bachelor in 'Construction' by means of a road show in Flanders.

The public employment service has perceived that occupations that increase in importance are not necessarily easily accessible for unemployed persons. For example, in a company the current employees are trained to fit solar panels, whereas unemployment persons are attracted to take in the place of these employees in the conventional activities. Therefore, one should keep focusing of providing good basic training adapted to new techniques and changing needs, but not try to create totally new training modules that are targeted at a certain niche within the sector. The programme has already been expanded with modules like green building and energy performance regulation.

Next to that, a bottleneck is that there are too few candidates with the necessary background to take on the training and be employed in the sector. Special itineraries have to prepare them for that.

2.5.4.2 Wallonia

In Wallonia, various types of training already exist for green building:

- Plate-Forme Maison Passive (PMP) organizes training on passive houses for architects and techniques for contractors and workers. Some courses are given to learn how to use software dealing with energy calculations and thermal bridges
- AID Tubize A.S.B.L. is an association of companies that provide green building training. Their training sessions are longer, lasting about ten months, and cover every field and general knowledge about green building.
- Centre de formation aux techniques spéciales du Bâtiment A.S.B.L (Cefortec) offers training on passive houses and on thermography.

[31] Edutec vzw offers training programmes with an innovative character for construction workers and students in construction. Partners involved are the sectoral training fund of the construction sector, Cevora, RTS and Bedrijfsopleidingen Open.

2.5.4.3 Brussels

Espace Formation PME and Bruxelles Formation offer a common training module on green building that covers the area of insulation, air tightness, water tightness and other general knowledge topics about green building. The training is aimed at unemployed persons as well as employees.

2.6 Conclusions

2.6.1 Number of green jobs

As the construction industry gradually shifts towards green building, even more green jobs will emerge. These will not necessarily be new jobs but rather a transformation of existing positions into greener applications and market segments.

70% of the Belgian construction companies are active in green building in one way or another. The Federal Planning Bureau estimated that, in 2005, 10% of Belgium's eco-industry's employment was in the construction sector, i.e. 6,600 FTEs.

2.6.2 Competences

The growing importance of green building makes the occupations more complex and the needed competences more extensive. To sum up, we define the following trends:

1. The **coordination role** becomes crucial: in order to achieve the necessary quality standards (e.g. energy performance), a good follow-up is needed. Better contacts are needed between the design and execution phases as well as within those phases and this requires more coordination work on the part of the architect and contractor. This has lead to the emergence of a new occupation: the construction coordinator.

2. The increased complexity in materials and techniques has lead to more **specialization** in both the design and execution phase. This reinforces the importance of the coordination role.

There is a clear need to update the competence profiles of occupations, which are becoming outdated. A dynamic instrument should be developed in order to be able to adapt the profiles easily.

2.6.3 Training

The growing complexity in a fast evolving sector leads to an important need for training at the different levels. Steps have already been taken to address these changing needs but additional efforts are necessary to strengthen this process and to stimulate the companies to invest in training.

Quite of a few educational institutions are geared towards the (future) employees of the construction sector: vocational training, higher education, Cevora and

Syntra (adult education), sectoral training fund and Edutec (sectoral education), and the Public Employment Service. Next to that, the manufacturers of building materials also offer training to employees to learn to work with their products. More harmony and complementarity are important points of interest. Each level could have its own focal points:

- Vocational and higher education, adult education, public employment services: **basic training** with special attention for new techniques and legislation.
- Sectoral education: **advanced training** focusing on new techniques
- Construction companies and manufacturers of building material: short, **specialized training** focusing on new products (and techniques)

There is also a shortage of good teachers with expertise in green building. Skilled persons most often work in the sector and are too busy to take on educational tasks. "Train the trainer" should therefore be a made a priority.

2.6.4 Inflow in the sector

In spite of the crisis, many occupations are remaining bottleneck functions because of the lack of interested and qualified candidates. Especially the working conditions are seen as the main pressure point, including for example flexible working schemes, physical stress, working conditions (open air, at high altitude). The inflow of both students and unemployed people is a point for attention. Good basic training is the most important prerequisite for this.

3 RENEWABLE ENERGY

3.1 Current state of the industry[32]

3.1.1 Definition

The renewable energy sector (RES) consists of several sub-sectors that differ in many aspects (stage of maturity, profitability, technology etc.) but that have as a common goal to generate "green" energy. The sub-sectors under consideration are defined as follows:

- **Hydropower** refers to the conversion of the kinetic energy of water into electricity in hydroelectric plants and forms part of the traditional energy mix.
- **Biomass** is the biodegradable fraction of products, waste and residues from agriculture (including vegetable and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste. Biomass resources can be converted into heat, power and transportation fuels using a range of different processes.
- **Wind power** refers to the conversion of the kinetic energy of wind into electricity using wind turbines.
- **Geothermal energy** is the energy stored in the form of heat below the earth's surface. Beside electric power generation, geothermal energy is today used for district heating, as well as for the heating (and cooling) of individual buildings, including offices, shops and residential houses.
- In the area of electricity generation from **sunlight**, two technologies currently dominate the market: photovoltaic (PV) and concentrated solar power (CSP). Photovoltaic generation refers to the direct generation of electricity from sunlight using solar cells based on semiconductor materials. The second method to turn sunlight into electricity is referred to as Concentrated Solar Power (CSP). CSP uses reflector shields (mirrors) to concentrate sunlight.
- **Solar thermal** energy consists of the use of sunlight for heating or cooling processes. Currently, the dominant application is hot water and space heating in residential and commercial buildings. Other applications include support to district heating, solar assisted cooling and industrial process heat.
- **Ocean energy** conversion technologies exploiting the kinetic energy of tidal and wave movement have not yet reached the commercial stage.

[32] This data is based on: DG Energy and Transport (2009), Belgium Renewable Energy Fact Sheet 2008, EC.; DG Energy and Transport (2008), Belgium Renewable Energy Fact Sheet 2007, EC.; Jespers K. et al (2008), Inventory of durable energy in Flanders 2008, VITO; IDEA Consult (2009).

Given the complexity of the sector and the possibility for "traditional" energy suppliers to differentiate towards green energy, the sector cannot be defined by means of the NACE-classification.

3.1.2 Figures in a global context

3.1.2.1 Production in Belgium

3% of total electricity generation in Belgium in 2005 was derived from renewable energy sources, of which 2.4% from biomass and 0.3% each from hydropower and wind energy[33]. In Flanders, the generation of "green" electricity increased by 21.8% between 2007 and 2008. It was thereby responsible for 4.1% of total electricity generation in the region.

Concerning heat production, a strong increase was observed in the share of renewable heat production in total heat production between 2006 and 2007 in Flanders, both due to a decrease in total heat production and an increase in renewable heat production. In 2007 and 2008, this share amounted to 2.1% of total heat production.

A third purpose of renewable energy, namely biofuels, is not exploited on a large scale in Belgium and Flanders. The share of biodiesel in total transport fuels in Flanders was 1.1% in 2007. In 2008, bioethanol was introduced in the Belgian market as well.

3.1.2.2 Production in Belgium per energy source

The large majority of renewable energy generation stems from biomass. It accounted for 71% of all renewable electricity generation in 2004[34] (82% in Flanders in 2007[35]), of which one half was derived from solid biomass, 21% from biowaste and 15% from biogas. In Flanders, solid biomass was even responsible for two thirds of biomass electricity production in 2007. Here, solid biomass has a share of 62% and biowaste and biogas, of 19% each. Biomass is also extensively used to generate heat in Belgium. It once again delivers the largest contribution to this type of renewable energy. Finally, biofuels are not exploited at a substantial level yet, although the region of Flanders sees this as a field of opportunity for the future.

The second largest source of renewable electricity generation in Belgium is hydropower. The share taken up by hydropower was 21% in 2004. This is a type of renewable energy that is typically more common in the Walloon region of the country. In Flanders, it amounts to close to 0% of electricity generation.

On-shore wind energy is the third source of renewable energy generation in Belgium, of which just over half is produced in Flanders, where it accounted for 17% of renewable electricity generation in 2007. Also in 2007, off-shore wind energy generation capacity was built on the Thornton bank, which is causing this source to grow in importance rapidly.

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33 DG Energy and Transport (2009), Belgium Renewable Energy Fact Sheet 2008, EC. (original data from Eurostat)

34 DG Energy and Transport (2008), Belgium Renewable Energy Fact Sheet 2007, EC.

35 Jespers K. et al (2009), Inventaris duurzame energie in Vlaanderen 2008 (Inventory of sustainable energy in Flanders 2008), VITO. (using data from VREG, ODE-Vlaanderen, VEA,…)

Other sources, mainly for heat production, are geothermal and solar thermal energy, both of which were only marginally exploited in Belgium in 2004.

An overview for Flanders of the net electricity generation in MWh by source is given in the following table[36]:

Table 15: Amount of net electricity generation by type of energy source

	Solar Energy	Wind Energy on land	Hydro Power	Biomass from agriculture or forestry industrie	Biomass from household waste	Biomass from sorted or selectively collected waste	Biogas - landfill gas	Biogas - RWZI	Biogas - other	Total
2002	5	44.218	1.678	0	0	54.714	37.506	1.501	10.420	150.040
2003	82	58.946	1.863	0	0	96.729	62.191	1.833	69.924	291.568
2004	393	95.044	1.926		52464	184.049	74.897	1.965	135.233	545.971
2005	715	154.446	2.283	112.443	159.505	304.481	77.050	2.620	154.746	968.289
2006	1.356	237.749	2.079	395.506	180.492	424.240	81.887	3.472	101.581	1.428.362
2007	5.582	284.520	2.733	424.321	186.602	488.698	74.926	4.342	172.820	1.644.544
2008	33.620	332.965	3.603	661.482	179.152	526.667	74.629	4.723	193.654	2.010.495
2009	138.615	386.851	2.970	824.072	203.543	698.176	64.212	5.024	364.444	2.687.907

3.1.2.3 Sectoral structure and figures (Europe)

The structure of the RES depends strongly on the specific sub-sectors. In many cases, SMEs are dominating but at the same time have difficulties in terms of finding capital and qualified personnel. Sub-sectors that consist mainly of SMEs are the solar thermal energy and geothermal energy. In hydropower and photovoltaic energy, there are more large firms and in wind power, a wide range of stakeholders are active.

Europe-wide, it is clear that the industry of renewable energy generation is a young and strongly growing sector. Renewable energy has a relatively higher average productivity and productivity growth than manufacturing. Also in terms of average profitability and profitability growth, its rate is higher. In terms of turnover, the European renewable energy sector is estimated to have substantially grown in the period 2004-2008 (107% to reach 26 billion EUR in 2008).

Almost 50,000 people[37] were employed in the European RES in 2000. This figure has grown strongly to reach 167,000 in 2008. Operating revenue per employee and its growth are higher than in the manufacturing industry as a whole. It is mainly in the R&D and set-up phase that activities are intensive with (highly skilled) workers, and labour costs are high. Once in the operating phase, labour costs are relatively low.

[36] Jespers K. et al (2009), Inventaris duurzame energie in Vlaanderen 2008 (Inventory of sustainable energy in Flanders 2008), VITO. (using data from VREG, ODE-Vlaanderen, VEA,…)

[37] These figures are estimations based on EPE data (environmental product expenditures), as described in IDEA Consult (2009).

3.1.2.4 Global competition

The EU RES is in a leading position in a global context. It accounts for 40% of world production. The sector is highly concentrated in a minority of Member States, such as Germany, Denmark, Italy and France.

A strong global competitor is Japan. This country faced severe consequences of the first oil crisis in 1973, which showed the dangers of dependency on oil imports. In reaction, energy efficiency and alternative energy sources, among which renewable energy generation, have been encouraged in Japanese policies. Nowadays, Japan performs particularly well in photovoltaic and solar thermal energy, and in geothermal and biogas energy.

In terms of renewable energy in its energy mix, India is world leader. This comes predominantly from the hydropower sector. India is also an emerging player in solar energy generation.

Other emerging countries are China and Taiwan. China is estimated to have taken the lead position as producer of solar cells (which until then was the position of Germany). However, only a fraction of the actual generation takes place in China itself, as most of it is exported to countries like Germany, Spain and the United States, that hold large shares of new installed capacity.

3.1.3 General characteristics

3.1.3.1 Maturity and automation

The RES consists of a variety of sub-sectors, as described above. Each of these sub-sectors has its own **level of maturity**. The hydropower sub-sector, for example, is at a rather mature stage where hydropower can compete with traditional energy sources and is already part of the traditional energy mix. Wind and solar energy are in a maturing phase where firms are organizing to become cost-effective, for example through consolidation and stock market listing. Other sub-sectors are in a very early phase of development, where projects have the purpose of research and demonstration, rather than immediate commercial profitability.

A large portion of the renewable energy sector (RES) is thus still in an **(early) phase of development**. To compete with the traditional energy suppliers that have been operating for a long time, many technological and innovative developments are still needed. Given that in general the sector is still not profitable in comparison with other energy sources, it therefore depends highly on public support for further development.

Another difference, important for the future profitability of the sub-sector, is the **degree of automation** that occurs in the projects. In geothermal and hydroenergy generation, mainly tailor-made solutions are required, while in solar and wind energy generation, a much higher degree of standardization is possible and the sub-sectors are therefore evolving towards production in the assembly lines of an automated process.

3.1.3.2 Capital requirements

Overall, the RES is characterized by **high-tech and complex services**. This is a comparative advantage for EU countries, of which some are world leaders in the domain.

Yet it also means that the sector is generally **capital intensive** and there are high financial requirements for start up and development. Typically, these up-front costs are very high (e.g. the R&D costs, but also the set-up costs of wind farms or biomass plants etc.) but the operation and maintenance costs are very low.

Even though the policy environment is very positive for RES, **investors** are not keen on taking risks by investing in SMEs in the industry in this early stage.

A trend that can be explained partly by this difficulty to find financing is that **traditional energy suppliers** are increasingly incorporating green energy supply into their business models. Most of the large companies (based on 2006 operating revenue) in renewable energy in Europe are subsidiaries of traditional energy suppliers. An example in Belgium is Electrabel NV (2nd in Europe). Yet a number of specialized companies also appear in this list of large suppliers.

3.1.3.3 Internationalisation

Internationalisation is mainly observed in these large suppliers, while SMEs are still strongly focused on their home markets.

3.1.3.4 Demand

The **demand** for renewable energy comes from commercial customers and project developers, but also from household-level users, e.g. solar panels for households or geothermal systems in sustainable housing developments.

Legislation is an important driver for each of them and is expected to remain so. It is responsible for awareness raising and financial incentives that lead the consumer towards renewable energy, whereas otherwise this would be considered too expensive to be a fully accepted alternative to traditional energy.

The following box gives an overview of the most important legislation for the sector of renewable energy in Belgium.

The European Directive 2001/77/EG on the production of energy based on renewable sources sets for indicative targets every Member State concerning the share of renewable sources in gross national electricity consumption. For Belgium this amounts to 6% by 2010. This has been taken over in the coalition agreements of the regions in 2004.

The new European Directive 2009/28/EG on the promotion of the use of energy from renewable sources imposes for every Member State binding targets concerning the share of energy from renewable sources in energy use. For Belgium, this amounts to 13% by 2020.

In Flanders and the Walloon Region, a system of green energy certificates has been introduced that are granted to acknowledged production systems that apply for these certificates.

Next to that, there are supporting schemes for investments for example the fiscal deduction on the federal level and regional subsidy schemes for solar panels and heat pumps.

Also, **prices of raw materials for non-renewables** are drivers or barriers for investing in renewable energy. When carbon and crude oil prices are low, it may be more cost-effective for energy producers to pay for emissions permits rather than invest in renewables.

3.1.4 Evolution in characteristics of the sector[38]

On the demand side, two trends are observed. On the one hand, consumer awareness grows due to big campaigns, financial incentives and high price levels for natural gas and oil. As a consequence, consumer behaviour is changing and more green energy is used. On the other hand, the consumer is not prepared to pay (considerably) more for renewable energy. Given the high level of R&D and technological complexity, however, prices should in this early stage be higher than prices from mature traditional energy suppliers. This leads to the observation that further development of the industry depends on financial incentives and public support, since high development costs cannot be charged in consumer prices.

On the development and operational side, collaboration with other sectors like green building and environmental technology providers is observed and advisable to be continued. It offers the advantage of building up expertise in a more general context and supported by other activities, so that product development and innovation are stimulated. Another opportunity for development is the development and exploitation of high-potential services like geothermal heat in the form of heat pump technology, solar assisted cooling, ocean energy systems etc.

Organisation-wise, consolidation is taking place. A driver for this trend is increased firm size and thus increased capacity to invest and attract funding. Examples of sub-sectors where a high rate of mergers is observed are the wind and solar energy segments.

One of the three targets in the Spring European Council 2007 is to attain a share of 20% renewable energy in the total EU energy consumption by 2020, and 13% specifically for Belgium. In this context, all categories of customers are expected to increase their use of clean energy in the energy mix. Especially important is the category of energy intensive sectors, which can shift to renewables only on the condition that further development and technological innovation allow for a steady and reliable energy supply. Already, big customers like energy suppliers are including the technologies for renewable energy into their organization.

Generally, the demand and production of renewable energy is expected to increase worldwide. The relative attractiveness of other energy sources could form a barrier for the development of renewable energy sub-sectors but an overall increase of energy demand is expected in the future so there is room for both renewables and non-renewables to continue growing. Moreover, awareness-raising initiatives and further evolution towards cost-effectiveness will have a positive effect on demand for renewables and it is therefore expected that the RES will continue growing.

This will bring about more activity and employment, but also more fierce competition at home and abroad. The emerging economies (e.g. China, India) are already putting pressure on the European industry because of their potential in cheap mass production. The changes that entail cost-effectiveness of renewable energy generation (like mergers and vertical integration) are therefore crucial to face this increased competition.

[38] The European figures and trends in this chapter are based on IDEA Consult (2009).

3.2 Employment in the renewable energy sector

3.2.1 Employment and labour market characteristics

Given the complexity of technology and operation, the sector of renewable energy generally requires a relatively **highly skilled workforce**, which gives an advantage to the EU countries. Yet, at the same time, an overall **lack** of this skilled workforce threatens the development and profitability of the sector.

It is also a **labour-intensive industry**, but especially in the manufacturing and R&D phases, less so in the operating phase. In the long term, it is therefore important not only to stimulate the use of renewable energy but also to keep development and production from moving to e.g. Asian low-cost factories.

Given the importance of R&D and the level of technological complexity in the sector, access to a highly skilled pool of human resources is crucial for retaining competitiveness. Currently, **education programmes are insufficiently adapted** to RES and should focus more on these specific technologies and their implementation.

3.2.2 Quantitative profile of employment

Direct and indirect employment can be found in the following activities related to the renewable energy sector:

- Supply of technological services and products to renewable energy producers
- Installation of renewable energy generation infrastructure
- Production of renewable energy
- Maintenance of renewable energy generation infrastructure
- Research and development in the domain of renewable energy
- Financial services to the renewable energy sector (e.g. project finance, venture capital with a special focus on this sector)

Several initiatives have been taken to measure the employment in the sector of renewable energy; however none of them have fully captured the amount of employees in the sector as the above activities are divided over different NACE sectors and difficult to differentiate from other activities. The estimates are based on surveys among companies in the sector.

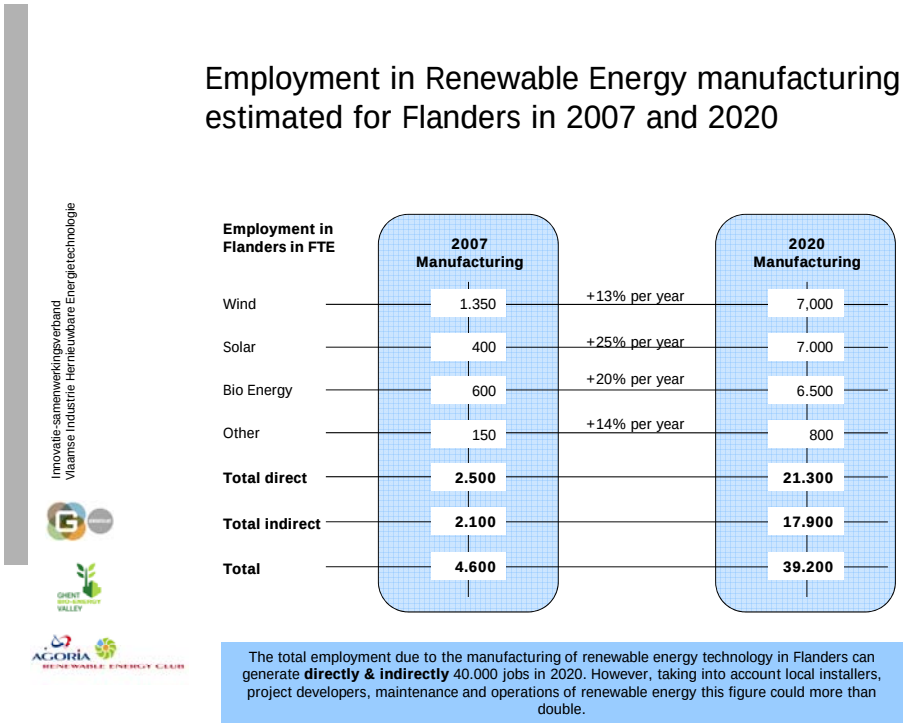
3.2.2.1 Figures for Flanders

A survey carried out by 3E and Agoria focuses on the **companies that supply technological services and products to renewable energy producers** in **Flanders**. It was launched among the members of Generaties, which is a technology platform that counts 85 members and brings together companies and knowledge centres active in renewable energy generation. In this way, the following activities were included: wind technology, solar technology (mainly

photovoltaic), bio-energy (biomass and -fuel) and others (e.g. heat pumps, consulting…).

As presented in the next figure, the total number of employees is estimated to have been about **2,500 in 2007**, mainly thanks to some large players in wind technology (namely Hansen Transmission International, Pauwels Trafo).

Figure 5: Employment in 2007 and 2020 in the renewable energy sector in Flanders



Next to the direct employment of this subsector of the renewable energy sector, an **estimation of the indirect employment** was made. Employment in the companies that supply this subsector was quantified by means of the Input-Output tables of the Federal Planning Bureau, using more specifically the employment multiplicator of the manufacturing sector as it mainly concerns technological companies active in electrotechnics, metalwork, etc.

This lead to a total number of **2,100 indirect jobs** and therefore to a total of **4,600 direct and indirect jobs in 2007** linked to the technological companies active in the renewable energy sector.

A future scenario was also analysed to measure the possible evolution in employment by 2020. This scenario was based on:

- The scenarios of the International Energy Agency that gives an estimate on the future evolution of electricity production per type of technology.
- Forecasts of different European sector federations (EWEA for wind, EPIA for sun and AEBIOM for biomass) in relation to the growth in production capacity.

- The results of technology exploration in the platform activities of Generaties, which include higher productivity growth than in the above scenarios.

- An estimation on the extra jobs created in spinoff activities of research institutions and companies based on the knowhow of sector experts. Because of the speculative character, a rather cautious estimate was done.

Based on the above assumptions, the proposed scenario leads to a total of **21,300 direct jobs in 2020**, equally divided over wind, sun and biomass energy. Also including indirect employment, this number rises to **39,200 direct and indirect jobs in 2020**.

Because employment in the installation of renewable energy systems is underestimated in the survey results, an "educated guess" has been made by 3E for Flanders. This estimation is based on the employment rate per installed megawatt which is addressed in a few studies[39]. The following rates have been selected: 15 jobs per installed MW for solar energy, 9 for wind and 3.5 for biomass. The differences are clarified by the fact that it is much more labour-intensive to install 1 MW of photovoltaic than 1 MW of windmill or biomass energy.

If these rates are applied to the total increase in installed MW in PV, wind and biomass during 2009 (respectively 230 MW, 56 MW and 69 MW), a total number of **4,195 direct jobs** is obtained in 2009[40]. The figure does however not take into account where the employment is created, in Flanders or elsewhere. Concerning photovoltaic energy, it is presumed that most of the employment is created here as there is a large rise in companies that specialize in this field.

All things considered, it is estimated that the renewable energy sector in Flanders employed about 10,000 people in 2009. This is based on the cumulation of (1) an extrapolation of the results of the Agoria survey (3,500 direct jobs and 3,000 indirect jobs) and (2) the estimation of the employment with installers (4,195 direct jobs).

3.2.2.2 Figures for Belgium

A new survey by Agoria carried out in 2009 includes Belgian companies that supply technological services and products to renewable energy producers, as well as the larger companies that install or maintain infrastructure[41]. Concretely the following activities are involved: design, development, production and commercialization of materials, components, products and systems as well as the supply of complementary services (cf. consultants, installers, maintenance companies) active in the generation of renewable energy. The energy generation as such, exploitation of sites, financial services and research by public institutions (universities) are not included in the survey. In total, 115 companies were selected and 105 have cooperated in the survey.

39 WWF (2009), Low carbon jobs for Europe: Current opportunities and future prospects, Brussels; PVGroup, Jobs more important than price per watt to key policy makers. Greenpeace (2008), Energy (r)evolution. A sustainable world energy outlook.

40 Rise in installed capacity in 2009 based on figures of VREG and VITO. These data can be found at: http://www.vreg.be/vreg/documenten/Statistieken/56603.pdf and http://www.emis.vito.be/inventaris-duurzame-energie.

41 Agoria (2010), BE.Renew 2009. The Belgian Renewable Energy sector in a glance.

This survey resulted in an estimation of **6,925 direct jobs in Belgium**, of which 65% in Flanders.

3.2.3 Dynamics of jobs and competences

The renewable energy sector is a rather young and growing sector and covers different kinds of occupations: electricians, engineers, buildings site managers, technicians (for maintenance), agronomists and geologists. Depending on the type of activity, one or another occupation is more or less represented. This is illustrated in the following table.

Table 16: Occupation per type of renewable energy

Type of renewable energy	Typical job
Photovoltaic	Electrician
Solar thermal energy	Electrician
	Heating engineer
Heat pump	Heating engineer
Firewood	Engineer
Wind Power	Project manager
	Building site manager
	Engineer
	Technician
Hydraulics	Engineer
Biomethanation	Agronomist
Geothermal power	Geologist
Biofuels	Agronomist
Cogeneration	Engineer

Source: RDC Environnement based on interviews

All of these occupations have already existed for a long time but now have an extra dimension, i.e. renewable energy generation. New and / or changing skills are related to this new field of application and the specific knowledge needed, e.g. an engineer employed in the wind energy sector needs to know more about aerodynamics. According to the handbook for Career Advisors and Occupational Councillors, many of the professions in renewable energy originate from the traditional science and engineering and business and management fields[42].

[42] Slingenberg et al (2008), Environment and labour force skills: overview of the links between the skills profile of the labour force and environmental forces, Rotterdam.

The changes of skills for those occupations related to construction have been described in more detail in the case of green building.

According to the UNEP study on green jobs, the majority of technologies used in the renewable energy sector do not necessary require highly skilled workers to operate them. Higher skills are required for biofuel processing[43]. However, other signals are seen in Belgium and Europe, and are described in the following paragraph.

3.2.4 Labour market bottlenecks in the sector

3.2.4.1 Filling vacancies

The Flemish Administration of the Environment carried out a survey in 2009[44] with regards to different employment aspects in the sector of renewable energy generation. The major bottleneck for filling the vacancies proved to be the lack of technically skilled personnel with the right competences. More concretely, there is an important shortage of engineers in general and of engineers with knowledge of the renewable energy technologies (wind, heat pumps, thermal simulations…) in particular. As a consequence of this, companies are recruiting more and more internationally.

The same shortages are perceived in other developed countries like Germany, one of the forerunners of renewable energy. And it is expected that highly skilled personnel will become even more important in the future[45].

Concerning installers, companies are looking for trained fitters with the right work ethics. For technicians, the sector observes a poor reaction to vacancies.

3.2.5 Education

Training needs exist in all phases of renewable energy projects, from project development and construction to production and maintenance. For each of the specific segments of the renewable energy sector there is a lack of employees with the proper skills. We give a number of examples in the next paragraphs.

Concerning wind energy, there is a need for (technical) training programmes in wind energy as they have already been developed in the neighbouring countries e.g. the Netherlands. These training modules should be based on the existing wind skill standards (www.windskill.eu).

There is also a need for extra training of professional target groups that are active in construction like sanitary fitters and electricians. A number of initiatives have already been taken, also by the public employment service, as we mentioned in the green building case. We refer back to this case for a more detailed description.

[43] UNEP (2008), Green jobs: Towards decent work in a sustainable, low-carbon world, Worldwatch Institute, Washington DC.

[44] 148 companies have participated to this survey.

[45] GHK (2009), The impacts of climate change on European Employment and Skills on the short to medium-term: a review of the literature, Final report (volume 2), London.

Also the maintenance of wind turbines is often outsourced to foreign companies because adequately skilled technicians cannot be found in Belgium.

3.3 Conclusions

The conclusions for the renewable energy sector include both labour market issues as well as the policy necessary to stimulate demand for renewable energy.

3.3.1 Technical education

The bottlenecks for the renewable energy sector correspond to those perceived generally in the manufacturing sector as a whole. Technical profiles are rare but very much needed, as illustrated by surveys, analyses of sector federations and the bottleneck functions listed by the public employment services.

Given the current and expected growth of the renewable energy sector, this overall shortage of technical skills is problematic and can cause serious hinder to further growth if not tackled. It is absolutely necessary to invest in and promote technical education in order to keep up with the demand for technical profiles.

3.3.2 Continuity in policy

The generation of electricity based on renewable energy sources is at present not competitive compared with fossil and nuclear alternatives. Only the current system of green energy certificates that has been introduced at regional level allows the investor to obtain a satisfactory return and convince investors (both industrialists and private persons) to install renewable energy systems.

The technology roadmaps indicate that the costs of different renewable energy resources will continue to decrease in the future. Together with rising oil prices, this should lead in the near future to a 'grid parity'. This means that the production costs of renewable energy should reach the same level as those of commercial energy prices. In this situation, green energy certificates are no longer necessary to guarantee a sound business plan.

However, as long as this situation has not yet been reached, changes in the system of green energy certificates should be dealt with cautiously as investments have a depreciation period of at least 20 years and investors wish to have a view on the expected costs and profits during the length of this period. And as investments have an important effect on employment in the renewable energy sector, this is an important point for attention for further growth in the sector.

Crucial to the further development of renewable energy generation is a mid-term and long-term policy vision. Continuity is important to create certainty and confidence in the market so that investors, producers and consumers are prepared to turn increasingly to renewable energy.

3.3.3 *Internationalization and innovation*

Concerning the production of components and installations, increased competition from the Far East is observed. Therefore it is important to monitor the correct implementation of the free trade agreements.

Furthermore, Europe aims for technological leadership in renewable energy technologies by means of the Strategic Plan for Energy Technology (SET). It is important for Belgium to take part in this evolution, e.g. through the selection of high-potential research topics and further stimulation of research and development of the sector. In this respect, the renewable energy potential of Belgium needs to be clearly evaluated and the innovation policy adjusted accordingly.

3.3.4 *Administrative burden*

Administrative rules are also a barrier for the development of renewable energies. Facilitating administration can boost investments by making the entrance into the market easier. As an example, in the Walloon region, electricity can only be sold to third parties if severe administrative requirements are met. This leads in practice to a barrier so high that no electricity is sold to third parties. This may constitute an important barrier for small cogeneration facilities due to payoff problems when they cannot use all electricity generated for personal use. The remaining electricity is then sold to the main network which is subject to the call price and thus much less profitable than under negotiation with third parties.

Part 5: GREEN JOB INDICATORS

1 GREEN JOB INDICATORS

1.1 Introduction

One of the objectives of the study was to provide a list of indicators that are capable of monitoring the green economy and more specifically the green jobs concept. However, after consulting existing literature and data sources, and in line with what has been described in the previous chapters, we find that it is not yet possible to select and propose a coherent set of indicators that are able to monitor green jobs as such. The main reason is that the definitions, the concepts and the quantification of the green economy and green jobs are still being developed both in Member States and at EU level.

Our contribution will therefore focus on a more general discussion about the further development of a system to monitor the evolution of green jobs. In the following sections we will discuss what could be included in the green jobs monitor and what the conditions and next steps are in the development of green jobs indicators. We focus hereby on the EU policy level because the study should contribute to the preparation of the EU presidency of Belgium in the second half of 2010.

1.2 What can be monitored

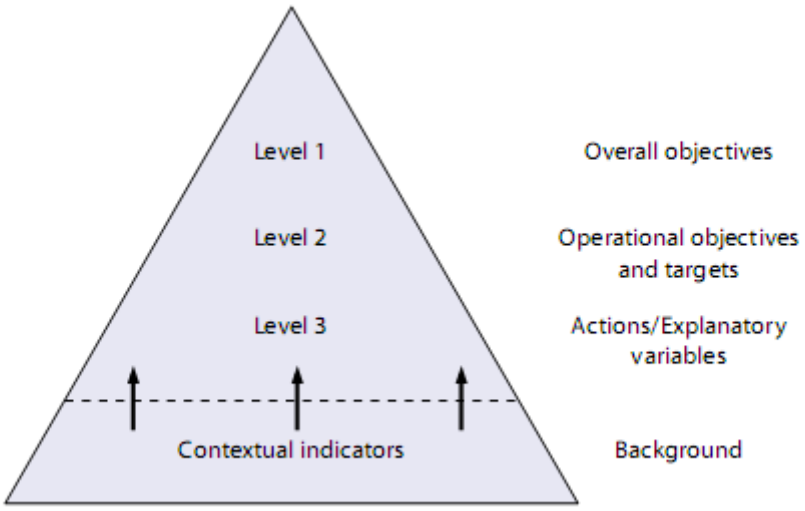
In order to set up a monitoring system, one can use a policy strategy or a concept or theoretical framework as a starting point.

1.2.1 Policy approach

Usually, indicators are used to monitor policy objectives and policy strategies. They are part of a monitoring system that forms a structure around a certain number of indicators. The relation between the indicators is determined by the policy cycle: we can distinguish between input indicators, throughput (process) indicators, output indicators, results and impact indicators.

We can mention two examples at EU level among many others. The European Employment Strategy, as part of the EU Strategy for Jobs and Growth, is monitored by a set of indicators selected under each of the Employment Guidelines. The indicators monitoring the Employment Guidelines are grouped per Guideline and distinguish between indicators for monitoring and indicators for analysis. Another example relates to the EU sustainable development strategy that is monitored by the report "Sustainable development in the European Union. 2009 monitoring report of the EU sustainable development strategy" (Eurostat). The sustainable development indicators are clustered by policy priority issue. For each cluster, there are different types of indicators in relation to the policy objectives and actions: indicators describing actions and explanatory variables, indicators in relation to operational objectives (results), indicators in relation to the overall objectives (results/impacts). The figure below illustrates the structured approach.

Figure 6: Sustainable development indicators pyramid



Source: Sustainable development in the European Union. 2009 monitoring report of the EU sustainable development strategy (Eurostat)

Turning to the green job indicators, we notice that policy objectives for green jobs are found in different policy areas and policy strategies, which partly explains the challenge in establishing a structured set of indicators. We found a few objectives specifically related to green jobs, in the following strategy documents:

- the EU's Package for climate and energy (EC, 2008) contains two objectives: "more jobs in environment related industries" and "1 million jobs in renewable energies by 2020"

- Part II of the Europe 2020 integrated guidelines (EC, 2010) puts forward the following objective within the context of guideline 7 Increasing labour market participation and reducing structural unemployment: "…Stimulate the creation of green jobs…"

In other policy strategies, the transition to a green, low-carbon economy is mentioned as one of important structural trends influencing labour market needs and skills needs. The 'New skills for new jobs[46]' communication states the following:

"Across Europe, the shift to a low-carbon economy and the growing importance of the knowledge economy, in particular the diffusion of ICTs and nano-technologies offer great potential for the creation of sustainable jobs. Globalisation, ageing populations, urbanisation and the evolution of social structures also accelerate the pace of change in labour market and skills requirements."

[46] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - New Skills for New Jobs - Anticipating and matching labour market and skills needs {SEC(2008) 3058}.

Also the current Employment Guidelines 2008 - 2010 have not formulated a specific objective. The Employment Committee, whicgh is responsible for the development of indicators monitoring the Employment Guidelines, is currently working on a proposal for indicators monitoring green jobs.

1.2.2 Concept-based approach

As the basis for a policy approach is relatively fragmented, we depart from the findings on the green employment in previous chapters in order to distinguish different angles for the development of green job indicators. The different concepts that could be monitored are the following:

- Green jobs and the quality of green jobs
- Green workplaces and work organization
- Greening of the economy (green growth)
- Adaptability of the labour market as a condition for supporting the transition towards a greener economy (flexicurity and skills)

1.2.2.1 Green jobs and the quality of green jobs

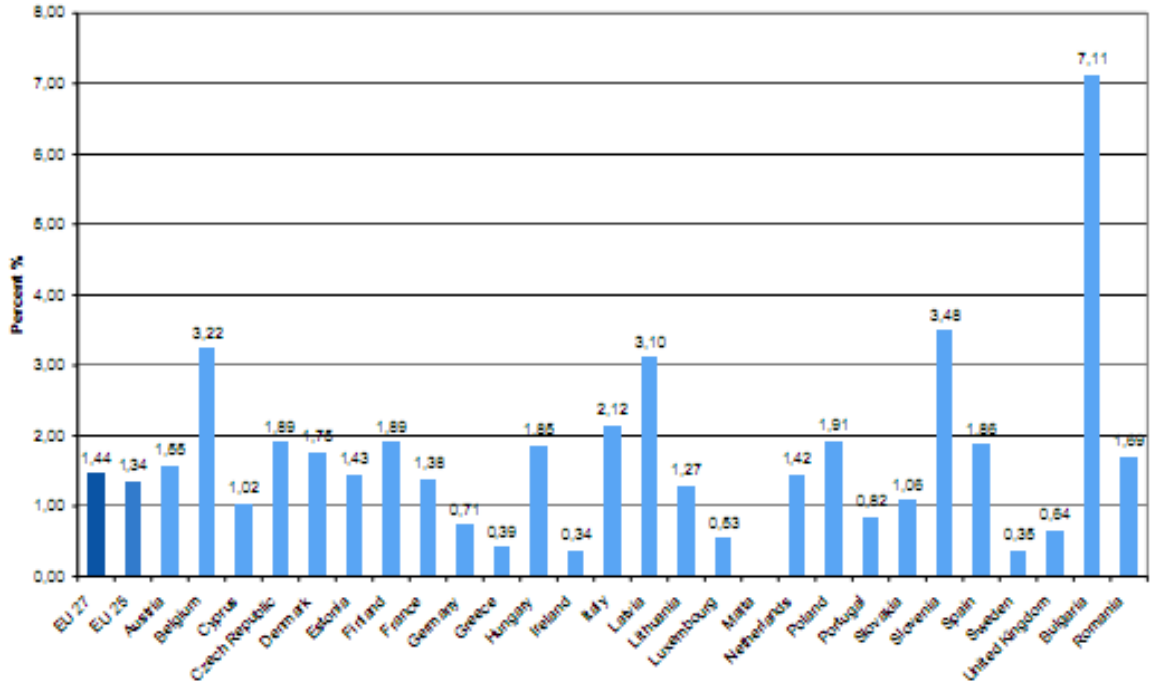
First of all, in order to measure **green jobs/green employment**, it needs to be decided if we want to measure jobs in green sectors or activities. This refers to the activity-based concept of the green economy proposed in Part 2 of the study. Alternatively a broad concept of green jobs could be measured whereby a green job will be identified based on specific characteristics of the job (cfr UNEP definition).

We are strongly in favour of measuring employment in green sectors in line with the activity-based concept that was developed. In this concept, there are four types of green activities: core, connected, depending and other activities. More specifically, we believe that the EGSS methodology that is being developed by Eurostat (pilot study 2010, ongoing) provides the best available method to come in a relatively short period of time to comparable EU data measuring **employment in core green activities**. The analysis by the Federaal Planbureau approaches this concept closely and can be considered as a good proxy for employment in core green sectors in Belgium.

Looking further down the line, it is clear that measuring jobs in connected activities is (1) not easy because of the combination of green and non-green activities in one sector e.g. the production of hybrid cars cannot be separated from the production of traditional cars and (2) sometimes irrelevant because green activities are highly integrated within the traditional activities e.g. green building. One of the disadvantages of the proposed EGSS method is that it underestimates the total number of jobs related to green activities as it does not sufficiently cover connected activities nor does it include depending activities although these are becoming more and more important.

Other studies have used different methodologies, for example the study on the competitiveness of eco-industries' estimated employment based on environmental expenditure. For Belgium this leads to a proportion of green in relation to total employment of 3.22% (2008), see Figure 7. However, this leads to an overestimation as not all employment is created in Belgium but also elsewhere through the import of goods and services.

Figure 7 Eco-industry employment as share of total workforce in 2008



Source: IDEA Consult (2009), Study on the competitiveness of the EU eco-industry, Brussels.

Next to **direct employment** in the core green sectors, it is interesting to look at the **indirect employment** related to the core green sectors. In this way, one could compare the leverage effect of green sectors with the leverage effect of other sectors.

To measure a broad concept of green jobs, as for instance understood in the UNEP definition, seems to be very difficult if not impossible with the currently available studies, data sources and methodologies because the different elements of the definition are not specific enough for immediate use.

Measuring the **quality of jobs in core green sectors** includes applying the common set of indicators for measuring quality of jobs. From an operational point of view, this is possible to the extent that the EGSS delimitation of green activities is compatible with sector categories used in data sources for the quality of work indicators (SILC, Labour Force Survey, EWCS….)[47]. In this way it should be possible to compare the quality of jobs in core green sectors with the quality of jobs in other sectors.

1.2.2.2 Greener work organization and workplaces

Measuring the **contribution of work organisation and workplaces to the greening of the economy** is a perspective that has been raised during the steering committee meetings for this project. Under this heading we can categorize indicators measuring teleworking or work-home mobility patterns that can be beneficial for the transition towards a green economy.

[47] DG Employment, Social Affairs and Equal opportunities (2009), Employment in Europe 2008, Chapter 4, EC.

Also, the concept of green workplaces is introduced here. A green workplace is considered to be a workplace that is beneficial to the environmental quality and also to the workers who are working in the workplace[48]. Finding out how many workers are working in a green workplace or the extent to which workplaces are green is another unsolved issue. One idea is to count the number of persons employed in organizations that fall under a label reflecting environmental efforts. There is a label indicating the environmental quality of office buildings (Breeam certificate). An international ISO-standard, ISO 26000 on corporate social responsibility, is being developed and environment is one of its core elements[49]. A last example is the EMAS certificate. Eco-Management and Audit Scheme (EMAS) is a management tool for companies and other organisations to evaluate, report and improve their environmental performance.

1.2.2.3 Greening of the economy (green growth)

The concept of green growth enables a broader look compared to the activity-based approach; elements related to the green transition are identified in the whole economy and in all sectors. In order to measure the transition towards a green economy, many indicators are available. It is possible to look at inputs eg. environmentally-related investments and R&D; processes (eg. innovation) or impacts eg. reductions in CO^2 emissions by sector. Considering the impact areas, one has to take into account the complexity in the interpretation of indicators since other factors than environmental efforts can influence them, eg. economic downturn leads to a reduction in production and thereby contributes to a reduction in CO^2 emissions. However, in this field a lot of expertise has been built up and a broad range of indicators and data sources are available. A description of a monitoring framework can be found in "An indicator-based assessment framework to identify country-specific challenges towards greener growth (Note for the LIME meeting)" (DG Economic and financial affairs, 2009).

1.2.2.4 Adaptability of the labour market

Since green growth is a dynamic process resulting in a transformation of the economy and also causing dynamics in employment and skills, the extent to which labour markets are capable of responding to and providing support for the transitions will be important for the success of the green transition. Crucial elements to be monitored are in the field of education and lifelong learning, life course policies, active labour market policies, labour market transitions, anticipated labour market and skills needs, flexicurity policies. These issues are already included in today's labour market and training policies, and monitoring systems are in place (cf Indicators for Employment Guidelines).

1.3 Conditions and steps for the development of green job indicators

In order to move forward and come to a feasible set of green jobs indicators, several conditions need to be fulfilled and steps need to be taken.

- It is essential to reach a consensus on the concept of green growth and green jobs, and more specifically on the methods to quantify the chosen

[48] An example of the concept can be found in 'How to green your workplace', TUC (www.tuc.org.uk)

[49] Also ISO 14001 on environmental management could be relevant

concepts. Many options are available, including the concept developed during this study. It is also possible to include more than one concept in the green jobs monitor, for instance an activity-based concept and a concept related to green growth, thereby including an economy-wide view on green evolutions. The combination of different concepts could also give a better insight into the way green growth is becoming visible / tangible in the economy and the labour market.

- To reach this consensus, different approaches are possible: a leadership approach where one body takes the lead and develops the green concept (and other bodies accept the leadership), a fragmented approach where each country/region/policy area makes up its own set of indicators; and finally a network model where all interested parties can contribute (open source method, multidisciplinary approach).

- We are in favour of a multidisciplinary approach where sector specialists, experts from different policy areas, experts in statistical data collection and data sources can participate because of the specific mechanisms behind green growth, evolutions in green sectors, relations with other sectors etc.

- A choice needs to be made between the integration of green job indicators in the existing framework of indicators for the Employment Guidelines or the elaboration of a separate monitoring system.

- A special point for attention is the international comparability of the indicators. Given the global nature of environmental challenges, especially also the challenge of climate change, it may be useful to develop indicators that are common not only at EU level but also with the OECD, the ILO and other institutions. Currently, the OECD is setting up a project on green growth and implications for the labour market. In the USA, the Bureau of Labor Statistics is preparing estimates of green jobs (http://www.bls.gov/green/).

- Finally, when selecting and presenting indicators, general guidelines and principles for the construction of quality indicators need to be taken into account.

    - It is possible to select existing and non-existing but desirable indicators. We suggest that the share of existing (measurable) indicators should be 75% or more. Indicate where the gaps are. If necessary, advise the collection of additional information in order to fill the gaps

    - Existing indicators can come from a wide variety of databases, information sources and/or monitoring frameworks. Many EU resource centres are available: Eurostat, Joint Research Center, Eurofound, EC (DG ECFIN LIME assessment framework[50]).

    - Indicators must fulfil SMART and other quality criteria (robustness, easy to interpret, EU-wide country coverage…)

[50] DG Economic and Financial Affairs and the Economic Policy Committee (2008), The LIME assessment framework (LAF): A methodological tool to compare, in the context of the Lisbon Strategy, the performance of EU Member States in terms of GDP and in terms of twenty policy areas affecting growth, European Economy. Occasional Papers n°41. October 2008. Brussels.

Part 6: CONCLUSIONS AND RECOMMENDATIONS

1 CONCLUSIONS

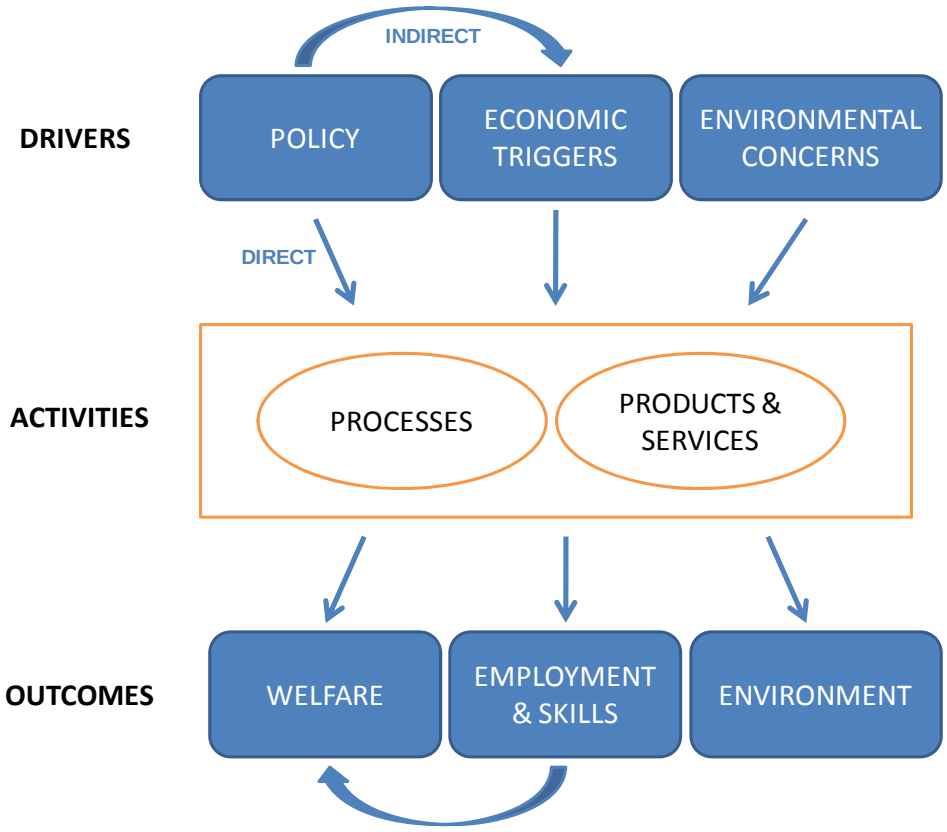
1.1 Conceptual framework

A dynamic framework for the green economy and green jobs has been established

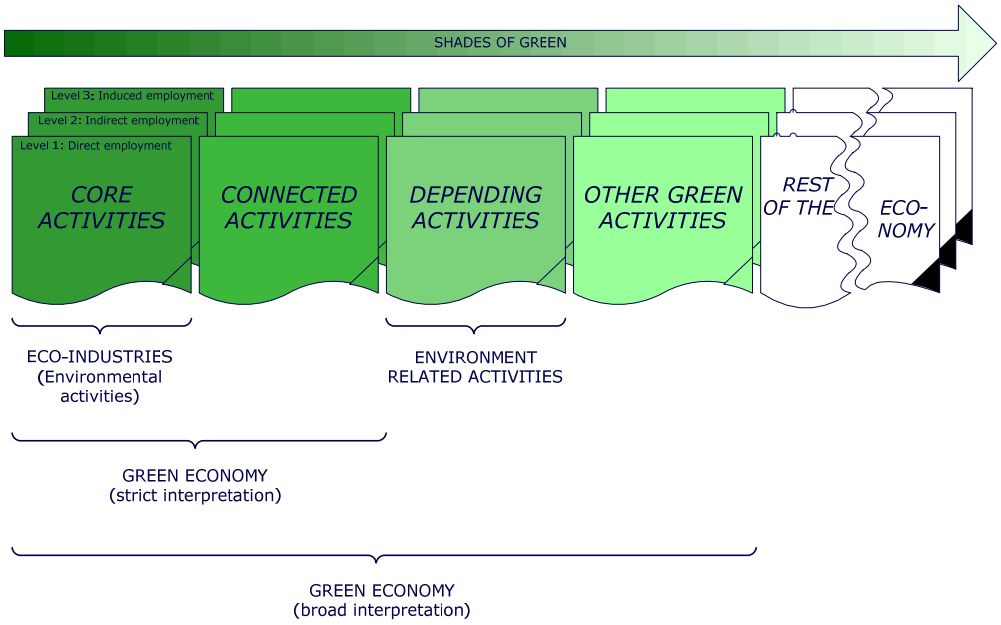
Despite the growing number of (academic) studies and policy documents in the field of climate and the environment, the discussion lacks a common framework and common concepts. The different stakeholders involved look at the green economy and green jobs from diverse angles, and give a different meaning to both concepts.

Based on an intensive analysis and consultation procedure, we have developed an original comprehensive framework that enables a better insight into the green transitions. The framework is composed of two elements:

1. An overview diagram integrates the **different points of view** in one framework by clearly distinguishing between drivers, activities and outcomes of the green economy (Figure 1: The macro-components for the conceptual framework).



2. The second part includes the different economic sectors in one single concept for the green economy and shows the **different shades of green** in our economy (Figure 2: Conceptual framework of the green economy). We make a distinction between core activities (primary goal is protecting the environment), connected activities (secondary goal is protecting the environment), depending activities (depending on a good environment), other green activities (positive effect on environment) and the rest of the economy. It also clear that this concept is dynamic : to the extent that the economy and all its activities are becoming greener, more and more activities will shift into a (darker) shade of green.



An activity-based approach is the most pragmatic way to look at the green economy

In most international studies **activity-based concepts** are used where green sectors are identified by the type of products or services they procure. An activity-based approach of the green economy with a focus on products and services is the best starting point for quantification and policy-making for three reasons:

1. Comparability: it is in line with international literature and therefore it builds further on the development of existing concepts, most notably by Eurostat and the OECD.

2. Measurability: it is a concept that is measurable since it is closely linked with the conceptual framework of Eurostat and the OECD. Especially in comparison with the dynamic nature of 'processes', the activity-based approach is easier to quantify.

3. Relevance: it is expected that the improvement of labour market policies in the light of support to green economic transitions benefits from a clear and focused definition of green economy rather than from a broad, less tangible concept.

However, policy makers are also interested in the impact of policies on the green economy or green transitions in the entire economy. These topics are harder to

quantify and therefore more difficult to monitor, but are nevertheless important to assess.

1.2 Quantification of the green economy and indicators

The manual on EGSS is the best available method for measuring green jobs (i.e. employment in the green economy) but is still under development for EU-wide application.

The Eurostat manual on the environmental goods and services sector (EGSS) is for the time being the best available method for measuring the number of green jobs. It is able to clearly identify green activities and it looks at the company data level to get an accurate view on employment in those green activities.

The manual is still under development for EU-wide application. Nevertheless, in Belgium the Federal Planning Bureau has already used a similar approach in the past and came up with a proportion of green in relation to total employment of 2% (2005).

However, the major disadvantage of the EGSS methodology is that connected activities are difficult to measure. Core activities are rather easy to define in terms of the companies and employment involved. Connected activities are often incorporated in traditional activities and difficult to separate, even by doing company level surveys. Jobs related to environmental activities in non-green sectors are also not taken into account. This means that the quantification results are often an underestimation of the total green employment. Also, not all activities within the green economy are green e.g. truck transport of green products, administrative functions, maintenance of infrastructure, etc. One can argue that this leads to an overestimation of green jobs.

Other studies have used different methodologies. For example the study on the competitiveness of eco-industries estimated employment in these industries based on the environmental expenditures. For Belgium this lead to a proportion of green in relation to total employment of 3.22% (2008).

The development of indicators in order to measure the dynamics of green jobs is challenging

This can partly be explained by the fact that policy objectives for green jobs are found in different policy areas and policy strategies (EU's Package for Climate and Energy, EU 2020 Guidelines). As the policy base is fragmented, we turn to concepts related to the green economy itself as a basis for a structured indicator set. The different concepts that could be monitored are the following:

- Green jobs and the quality of green jobs
- Green workplaces and work organization
- Greening of the economy (green growth)
- Adaptability of the labour market as a condition for supporting the transition towards a greener economy (flexicurity and skills)

1.3 Sector cases on green building and renewable energy

The case studies focused on those sectors with positive green dynamics, where opportunities are created in terms of activities and employment.

Environmental and climate policy have a strong impact on green sectors

The case studies showed a strong effect of environmental and climate policy, as they have a strong demand effect. In the construction sector, the Energy Performance of Buildings Directive (EPBD) raised the demand for sustainable construction and green goods and services. The Directive was rather quickly implemented in regional legislation in Belgium, however not binding from the first moment, with rather ambitious targets compared to the rest of the EU e.g. E-level of 80.

Furthermore, financial stimuli and campaigns from the (international) government stimulate consumers and companies to invest in energy efficiency and renewable energy.

The increase in demand for sustainable goods and services has an important impact on occupations and competences.

The dynamics of occupations and competences have two dimensions:

- **Volume**: Some occupations are more important than in the past while others receive less attention or even disappear. Sometimes new occupations arise due to specialization or to the need for totally new competences.

- **Content**: Occupations can also change in terms of job responsibilities or competences (which are a mix of knowledge, skills and attitudes).

Each sector has its proper internal dynamics of occupation and competences. In the case studies a strong transformation is observed in the construction sector, both in terms of volume and content, whereas the renewable energy sector has a stronger volume effect.

…thereby resulting in an increased need for qualified personnel.

The growing complexity in occupations in the construction sector in the different phases of the construction process and the growth of the renewable energy sector, where technical profiles are strongly represented, result in an increase in demand for technically skilled employees.

Both sectors face a lack of inflow of technical profiles, engineers as well as qualified blue-collar workers.

Furthermore, the construction sector has an important training need due to the increasing regulations and growing green building activities. This need concerns nearly all professions in the sector: architects, contractors, and executors like electricians, insulators and fitters of central heating. Also, the renewable energy sector has a lack of technicians with specific knowledge of e.g. wind energy.

The training needs are extensive in terms of (1) regulations (e.g. EPBD), (2) new techniques and applications (e.g. wind energy, passive housing) and (3) new products (e.g. roofing materials with integrated photovoltaic cells).

The need is greater with employees that with unemployed and young people in education as new market niches are mostly occupied by employees that used to working in the traditional activities (insiders) whereas job seekers are hired to replace the 'insiders' that moved on to jobs in the new niches.

Furthermore, 'training the trainer' is also a challenge in this context, as it is difficult to eg. find employees active in these new market segments (e.g. passive housing) that have the time to transfer their knowledge.

2 POLICY RECOMMENDATIONS

The policy recommendations result from the conclusions of the study and the feedback from the steering group committee. The purpose is to advise labour market policy makers in the way they should handle this emerging 'green economy'.

In general, the main objective of labour market policy is to stimulate an effective and fair balance between supply and demand on the labour market both in terms of quantity as in terms of quality[51]. From the analysis presented in this study it is clear that due to the transition to a green economy, certain imbalances have been created or reinforced and adequate responses are required.

The UNEP study 'Towards decent work in a sustainable, low-carbon world' mentions in the conclusions that the flexicurity concept may offer useful ingredients for labour market policies in support of the transition to a green economy. The European Commission considers flexicurity as an integrated strategy to enhance at the same time flexibility and security in the labour market; designed and implemented across four policy components: 1) flexible and reliable contractual arrangements, 2) comprehensive lifelong learning strategies, 3) effective active labour market policies and 4) modern social security systems providing adequate income support during transitions. Three elements can directly be applied to the conclusions of this study:

- **Active labour market policies** that support the transitions between jobs and in and out of the labour market are needed since jobs will be created but also disappear or become less important in the green economy
- **Flexible labour contracts and safe work organisations**: since we defined green jobs as jobs in green activities, it is clear that these green jobs are not by definition safe and providing good contractual arrangements. Flexible labour contracts could play a role in the expected shifts in jobs (in and between sectors).
- An **efficient lifelong learning system** providing the skilled workforce needed for the (green) economy as a response to the vast training need within green sectors

The main recommendations from this study add a horizontal dimension to these elements. Because of the dynamic nature and speed of the green transitions and the many common bottlenecks across the economy, labour market policies need to address the green challenges by means of an integrated approach (we could call this the 'greening of the flexicurity model'). Secondly, lifelong learning policies will remain extremely important but also require more interaction between skills supply and skills demand in terms of anticipation, strategy development and collaboration.

[51] Zwegers J.M.M. (2004), "Organisatie en arbeidsmarkt", Kluwer.

2.1 Integrated policy approach as an answer to emerging challenges

There is need to integrate green challenges in labour market policy; policy actions supporting green transitions must be integrated into mainstream policies.

There are many challenges that the Belgian and the European economy faces next to the environmental and climate issues such as demographic changes, international competition, etc. All these factors have an influence on the future of the European economy and employment.

Furthermore, it is clear that the green segment in traditional activities is growing but it is unlikely that the whole economy will be transforming towards a green economy and that only green activities will remain, at least not in a foreseeable future. Traditional and green activities are very integrated. Traditional products and services are (partly) used in the production of green products and services and conversely. Many companies combine both types of activities.

So it is clear that 'green transitions' are playing in every sector in terms of an increase in the production of green products and services, and an adaptation of production processes. All these changes have their impact on labour market needs.

Therefore, this means that the green transition should be integrated in the labour market policy as one of the important challenges next to other challenges like demography, globalization, etc.

An intersectoral policy is needed as there are many common bottlenecks

Every sector has its own dynamics on the labour market but many bottlenecks are common in both green and traditional activities such as the lack of technically qualified personnel. The green economy accentuates some of these bottlenecks. It is important to integrate the needs of different sectors and focus on those common bottlenecks in order to reach results.

2.2 Training and skills policies responding to volume and content changes in jobs

Technical education must be promoted in order to stimulate employment in the green economy

The demand for technically skilled employees is increasing, also in the green economy like renewable energy and green building, where technical skills are very important. There is a serious lack of candidates in technical education. The promotion and revaluation of these courses is crucial, in secondary and higher education as well as in the training of employees and job seekers.

There should also be access for European companies to hire talent from different places within or outside the EU in order to meet their labour demands.

There is a need for a proactive labour market policy that is able to react to (future) changes in regulation, activities and techniques.

It is important to have a pro-active labour market policy that is able to foresee changes in sectors and the implications for the labour market. International studies on green economy have been able to identify some general trends on macro and meso level but do not go deeper into detail in the changes in occupations and competences. It is absolutely necessary for labour market policy makers to gain a good perspective on the dynamics of occupations and competences in each sector, whether or not they result from green transitions, in order to be able to respond adequately for example by adapting training policies. The development and use of skill-forecasting techniques is therefore an important activity. Also, a set of green jobs indicators can contribute in this field, eg in order to identify trends.

It is recommended to focus on qualitative basic technical education, adapted to sectoral changes. Specific training, e.g. in new techniques or products, can be organized by the sector or at company level.

In the training of young people and job seekers, it is better to focus on qualitative basic technical education rather than new niches. The creation of new market segments often results in extra training needs but mainly for employees.

Of course, it is important to adapt curricula to sector evolutions to keep training courses up to date. This means that not only labour market policy should anticipate changes in occupations and competences but also educational policy.

For some specific niches, new training modules have been established. Harmonization of these curricula on a European level can also stimulate the exchange of knowledge and labour within the EU.

The quality of education also largely depends on the competences of the teachers. They too need to be trained in new developments in the sector.

There is need for cooperation, between sectors/companies and education on the one hand, and between different educational institutions on the other.

To keep training up to date, more cooperation is needed between sectors/companies and education. Curricula tend to adapt rather slowly to changes and as the green activities are evolving very rapidly, this is an important bottleneck. Therefore, it seems interesting to work more closely together with companies by integrating more work experience during the training itinerary.

Furthermore, many initiatives have been taken to address new training needs by different types of educational organizations but there is a lack of integrated vision on how to address training issues, specifically those arising from the green transitions.

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ANNEX 1: CLASSIFICATION AND DEFINITIONS USED IN THE FPB WORKING PAPER

From: L. Janssen & G. Vandille (2009), The Belgian environment industry (1995-2005), Federal Planning Bureau, Working paper 7-09.

1 Environmental activity according to the OECD Manual classification

In the **OECD Manual**, the environmental goods and services industry is classified according to the following three classification levels:

– Level 1 distinguishes three main types of economic environmental protection activity: A. Pollution Management; B. Cleaner technologies and products; C. Resource management.

– Level 2 distinguishes the main categories of environmental protection business activities for each of the three level 1 types of activity: production of equipment and specific materials; provision of services; construction and installation.

– Level 3 classifies enterprises according to the environmental domain of the performed activities.

The **Belgian environment industry** is therefore classified into the following categories:

1. Pollution management group

This group comprises goods and services that are produced solely with an environmental purpose and that have a significant impact on polluting emissions. A first division of this group is made according to the type of business activity. Each of these subgroups is further divided according to the environmental domain of the activities performed.

Production of equipment and specific materials for:

A.1.1. Air pollution control

A.1.2. Wastewater management

A.1.3. Solid waste management

A.1.4. Remediation and clean-up of soil, surface water and groundwater

A.1.5. Noise and vibration abatement

A.1.6. Environmental research and development

A.1.7. Environmental contracting and engineering

Provision of services for:

A.2.1. Air pollution control

A.2.2. Wastewater management

A.2.3. Solid waste management

A.2.4. Remediation and clean-up of soil, surface water and groundwater

A.2.5. Noise and vibration abatement

A.2.6. Environmental research and development

A.2.7. Environmental contracting and engineering

A.2.8. Analytical services, data collection, analysis and assessment

A.2.9. Education, training, information

Construction and installation for:

A.3.1. Air pollution control

A.3.2. Wastewater management

A.3.3. Solid waste management

A.3.4. Remediation and clean-up of soil, surface water and groundwater

A.3.5. Noise and vibration abatement

A.3.6. Environmental monitoring, analysis and assessment

2. Cleaner technologies and products group

This group comprises goods and services which reduce or eliminate negative environmental impacts, but which are often supplied for other than environmental purposes.

In Belgium, no firms are specialized in the production of equipment, technology or materials specifically for this group. All products and technologies are also used in either pollution or resource management, so this category was excluded.

3. Resource management group

The resource management group comprises goods and services which may be associated with environmental protection, although this is not their prime purpose. The purpose of these goods or services can be economic, like energy saving. The distinction between products for resource management and pollution management is not always clear. Often the same products can be used for both purposes or there is no detailed information about the final use of the product. If the purpose was not clear, activities were allocated to the pollution management group. In the following subdivision, only categories corresponding to activities performed by Belgian firms are displayed.

Production of equipment and specific materials for:

C.1.1. Indoor air pollution control

C.1.3. Recycling of materials (manufacture of new materials or products from waste or scrap, separately identified as recycled)

C.1.4. Materials for renewable energy plants

C.1.5. Heat/energy saving and management

C.1.6. Products used in sustainable agriculture and fisheries

C.1.7. Products used in sustainable forestry

Provision of services for:

C.2.1. Indoor air pollution control

C.2.3. Recycled materials (manufacture of new materials or products from waste or scrap, separately identified as recycled)

C.2.4. Renewable energy plants

C.2.5. Heat/energy saving and management

C.2.6. Sustainable agriculture and fisheries

C.2.7. Sustainable forestry

Construction and installation for:

C.3.1. Indoor air pollution control

C.3.3. Recycled materials (manufacture of new materials or products from waste or scrap, separately identified as recycled)

C.3.4. Renewable energy plants

C.3.5. Heat/energy saving and management

All environmental activities by firms and public authorities were classified according to this classification scheme. Subsequently, the enterprises and public authorities were individually labelled according to the above classification. Since one economic agent can conduct activities belonging to different classes in the scheme above, they can receive several environmental labels.

2 Allocation of environmental products by CPA code to the classification of the OECD Manual

CPA_code	EI_code1	EI_code2	Description
02.01.14	A.1.		Fuel wood
02.01.4	A.1		Other forestry products
02.02.10	C.7		Services incidental to forestry and logging
14.12.10	A.1.12		Limestone and gypsum
14.21.11	A.1.3		Kaolin and other kaolinic clays
14.30.11	A.1.22		Natural calcium or aluminium calcium phosphates; carnallite, sylvite, other crude natural potassium salts
14.30.13	A.1.22		Other chemical minerals
14.40.10	A.1.22		Salt and pure sodium chloride
14.50.10	A.1.3b	C.1.3	Bitumen and asphalt, natural; asphaltites and asphaltic rock
15.41.11	A.2		Animal oils and fats, crude and refined, except fats of bovine animals, sheep, goats, pigs and poultry
15.41.99	C.5		Industrial services for crude oils and fats
15.71.10	A.1.3b		Prepared animal feeds for farm animals, except lucerne meal and pellets
15.72.10	A.1.3b		Prepared pet food
15.83.20	C.5		Beet-pulp, bagasse and other waste of sugar manufacture
15.89.13	A.1.4		Yeasts (active or inactive); other single-cell micro-organisms, dead; prepared baking powders
15.92.1	C.1.45		Ethyl alcohol
15.98.11	C.1.23		Mineral waters and aerated waters, not sweetened nor flavoured
15.98.9	C.2.23		Industrial services for mineral waters and soft drinks
17.20.40	A.1.27		Pile fabrics, terry towelling and other special fabrics
17.30.21	A.2.27		Bleaching services of fabrics
17.40.16	A.1.1		Other furnishing articles n.e.c.; sets of woven fabric and yarn for making up into rugs, tapestries and the like
17.53.10	A.1.3		Nonwovens and articles made from nonwovens, except apparel
17.53.9	C.2.3		Industrial services for nonwovens and articles made from nonwovens, except apparel
20.51.11	A.1.3		Tools, tool bodies, tool handles, broom or brush bodies and handles, boot or shoe lasts and trees, of wood
21.21.99	A.1.2		Industrial services for corrugated paper and paperboard and containers of paper and paperboard

CPA_code	EI_code1	EI_code2	Description
21.25.1	A.1.2		Other articles of paper and paperboard n.e.c.
21.25.13	A.1.2		Filter blocks, slabs and plates, of paper pulp
23.20.22	C.5		Ethylene, propylene, butylene, butadiene and other petroleum gases or gaseous hydrocarbons, except natural gas
23.20.3	C.5		Other petroleum products
23.20.40	A.1.3c		Waste oil
23.30.9	A.1.3a		Treatment services of radioactive waste
24.11.11	A.1.1		Hydrogen, argon, rare gases, nitrogen and oxygen
24.11.12	A.1.13		Carbon dioxide and other inorganic oxygen compounds of non-metals
24.11.99	A.1.13		Industrial services for industrial gases
24.12.11	A.1.13		Zinc oxide and peroxide; titanium oxide
24.12.12	A.1.22		Chromium, manganese, lead and copper oxides and hydroxides
24.12.13	A.1.13	B.1.2	Other metal oxides, hydroxides and peroxides
24.12.22	A.1.13		Tanning extracts of vegetable origin; tannins and their derivatives; colouring matter of vegetable or animal origin
24.12.23	A.1.13		Synthetic organic and inorganic tanning substances; tanning preparations
24.12.99	A.1.13		Industrial services for dyes and pigments
24.13.11	A.1.22	C.1.22	Metalloids
24.13.15	A.1.13	A.1.22	Oxides, hydroxides and peroxides; hydrazine and hydroxylamine and their inorganic salts
24.13.21	A.1.1		Metallic halogenates
24.13.22	A.1.4		Hypochlorites, chlorates and perchlorates
24.13.31	A.1.22		Hypochlorites, chlorates and perchlorates
24.13.32	A.1.22		Phosphinates, phosphonates, phosphates and polyphosphates
24.13.33	A.1.22		Carbonates
24.13.41	A.1.4		Salts of oxometallic or peroxometallic acids; colloidal precious metals
24.13.42	A.1.4		Other inorganic compounds n.e.c., including distilled water; amalgams other than amalgams of precious metals
24.13.52	C.1.23		Cyanides
24.13.53	A.1.13	B.1.2	Hydrogen peroxide
24.14.11	A.1.22		Acyclic hydrocarbons
24.14.13	A.1.22		Chlorinated derivatives of acyclic hydrocarbons
24.14.14	A.1.22		Sulphonated, nitrated or nitrosated derivatives of hydrocarbons, whether or not halogenated

CPA_code	EI_code1	EI_code2	Description
24.14.15	A.1.22		Other derivatives of hydrocarbons
24.14.22	C.1.45		Monohydric alcohols
24.14.23	A.1		Diols, polyalcohols, cyclical alcohols and derivatives thereof
24.14.24	A.1		Phenols; phenol-alcohols and derivatives of phenols
24.14.32	A.1		Saturated acyclic monocarboxylic acids and their derivatives
24.14.33	A.1		Unsaturated monocarboxylic, cyclanic, cyclenic or cycloterpenic acyclic polycarboxylic acids and their derivatives
24.14.34	A.1		Aromatic polycarboxylic and carboxylic acids with additional oxygen functions; and their derivatives except salicyclic acid and its salts
24.14.41	A.1	A.1.4	Amine function compounds
24.14.42	A.1	A.1.4	Oxygen-function amino-compounds, except lysine and glutamic acid
24.14.43	A.1		Ureines; carboxymide-function compounds, nitrile function compounds; derivatives thereof
24.14.52	A.1		Heterocyclic compounds n.e.c.; nucleic acids and their salts
24.14.53	A.1		Phosphoric esters and esters of other inorganic acids, and their salts;derivatives thereof
24.14.62	A.1		Ketone and quinone function compounds
24.14.63	A.1		Ethers, organic peroxides, epoxides, acetals and hemiacetals and their derivatives
24.14.64	A.1	A.1.4	Enzymes and other organic compounds n.e.c.
24.14.71	A.1.22		Derivates of vegetable or resin products
24.15.10	A.1.22		Nitric acid; sulphonitric acids; ammonia
24.15.20	A.1.22		Ammonium chloride; nitrites; nitrates of potassium; ammonium carbonates
24.15.60	A.1		Animal or vegetable fertilizers n.e.c
24.16.51	A.1.33		Polymers of propylene or of other olefins, in primary forms
24.16.58	C.1		Other plastics, in primary forms, n.e.c
24.16.60	A.1.3b		Waste, parings and scrap, of plastics
24.20.14	A.1		Disinfectants
24.20.99	C.2.8		Industrial services for pesticides and other agro-chemical products
24.30.11	B.1.2		Paints and varnishes based on acrylic or vinyl polymers, in an aqueous medium
24.41.20	A.1.22		Lysine, glutamic acid and their salts; quarternary ammonium salts and hydroxides; phosphoaminolipids; amides and their derivatives and salts thereof
24.41.31	A.1.43		Lactones n.e.c., heterocyclic compounds with nitrogen hetero-atom(s) only, containing an unfused pyrazole ring, a pyrimidine ring, a piperazine ring, an unfused triazine ring or a phenothiazine ring system not further fused; hydantoin and its derivatives

CPA_code	EI_code1	EI_code2	Description
24.41.52	A.1.43		Hormones
24.51.20	A.1.43		Organic surface-active agents, except soap
24.51.32	A.1.43		Detergents and washing preparations
24.51.99	A.2.43		Industrial services for glycerol; soap and detergents, cleaning and polishing preparations
24.66.33	A.1.4		Hydraulic brake fluids; anti-freezing preparations and prepared de-icing fluids
24.66.41	A.2.43		Peptones, other protein substances and their derivatives, n.e.c.; hide powder
24.66.43	A.2.43		Chemical elements in disk form and compounds doped for use in electronics
24.66.44	A.1.22		Activated carbon
24.66.46	A.1.1	C.1.5	Pickling preparations; fluxes; prepared rubber accelerators; compound plasticizers and stabilizers for rubber or plastics; catalytic preparations n.e.c.; mixed alkylbenzenes and mixed alkylnaphthalenes n.e.c.
24.66.48	A.1.43		Miscellaneous other chemical products n.e.c.
24.70.14	A.1.3		Synthetic monofilament; strip and the like, of synthetic textile materials
24.70.24	A.1.43		Cellulosic and other artificial monofilament; strip and the like, of cellulosic and other artificial textile materials
25.12.10	C.1.3a		Retreaded pneumatic tyres, of rubber
25.13.10	A.2.3	C.2.3	Reclaimed rubber in primary forms or in plates, sheets or strip
25.21.21	A.1.3		Artificial guts, of hardened proteins or of cellulosic materials; tubes, pipes and hoses, rigid, of plastics
25.21.22	A.1.3		Other tubes, pipes, hoses and fittings, of plastics
25.21.30	A.1.3		Plates, sheets, film, foil and strip, of plastics, not supported or similarly combined with other materials
25.21.41	A.1.33		Other plates, sheets, film, foil and strip, of plastics, cellular
25.21.42	A.1.33		Other plates, sheets, film, foil and strip, of plastics, non-cellular
25.22.13	A.1.32		Boxes, cases, crates and similar articles of plastics
25.22.14	A.1.3		Carboys, bottles, flasks and similar articles of plastics
25.22.15	A.1.3		Other packaging products of plastics
25.23.13	A.2.2		Reservoirs, tanks, vats and similar containers, capacity > 300 l, of plastics
25.24.21	C.1.3a		Self-adhesive plates, sheets, film, foil, tape, strip and other flat shapes, of plastics, in rolls of a width ≤□20 cm
25.24.22	C.1.3a		Self-adhesive plates, sheets, film, foil, tape and other flat shapes, of plastics, in rolls of a width > 20 cm
25.24.23	A.1.32	C.1.3a	Tableware, kitchenware, other household articles and toilet articles, of plastics
25.24.24	C.1.3a		Parts n.e.c. for lamps and lighting fitting, illuminated name-plates and the like, of plastics

CPA_code	EI_code1	EI_code2	Description
25.24.28	A.1.26	C.1.3a	Fittings for furniture, coachwork or the like, of plastics; statuettes and other ornamental articles, of plastics; other articles, of plastics
25.24.90	A.1.	C.1	Manufacturing services of plastic parts
26.14.11	A.1.15		Slivers, rovings, yarn and chopped strands, of glass fibre
26.14.12	A.1.15	C.1.5	Voiles, webs, mats, mattresses, boards and other articles of glass fibres, except woven fabrics
26.15.26	A.1		Articles of glass n.e.c.
26.23.10	C.5		Ceramic insulators and insulating fittings
26.26.12	C.1.4		Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than of siliceous fossil meals or earths
26.51.12	A.1		Portland cement, aluminous cement, slag cement and similar hydraulic cements
26.52.10	A.1.13		Lime
26.53.10	A.1		Plaster
26.61.12	A.1		Prefabricated structural components for building or civil engineering, of cement,concrete or artificial stone
26.61.13	A.1.31		Pipes of cement, concrete or artificial stone
26.61.20	A.1		Prefabricated buildings of concrete
26.63.10	A.1		Ready-mixed concrete
26.66.11	A.1.31		Other articles of plaster or compositions based on plaster n.e.c.
26.66.12	A.1.31		Articles of cement, concrete or artificial stone n.e.c.
26.82.15	A.1		Artificial corundum
26.82.16	A.1		Non-metallic mineral products n.e.c.
27.10.20	A.1.31		Ferro alloys
27.10.31	A.1.31		Ingots, other primary forms and semi-finished products (of non- alloy steel)
27.21.10	A.1.27		Tubes, pipes and hollow profiles, of cast iron
27.21.20	A.1.27		Cast fittings, of iron or steel
27.22.10	A.1		Tubes, pipes and hollow profiles, of iron or steel
27.22.20	A.1		Tubes or pipe fittings, of iron or steel, n.e.c.
27.42.12	A.1		Aluminium oxide, excluding artificial corundum
27.43.22	A.1.31		Lead plates, sheets, strip and foil; lead powders and flakes
27.43.23	A.1.		Lead tubes, pipes and tube or pipe fittings
27.43.9	A.2.31		Industrial services for lead, zinc and tin and products thereof
27.44.12	A.1		Copper, unrefined; copper anodes for electrolytic refining

CPA_code	EI_code1	EI_code2	Description
27.44.13	A.1.3		Refined copper and copper alloys, unwrought; master alloys of copper
27.44.24	A.1.		Copper plates, sheets and strip, > 0.15 mm thick
27.45.30	A.1.3		Other non-ferrous metals and articles thereof; cermets; ash and residues
28.11.2	A.1.3		Structural metal products and parts thereof
28.11.23	A.1.3		Other structures and parts of structures, plates, rods, angles, shapes and the like, of iron, steel or aluminium
28.11.91	A.3		Installation (erection) work of self-manufactured metal structures
28.11.92	A.3		Repair and maintenance services of metal structures
28.11.99	A.3		Industrial services for metal structures and parts of structures
28.12.99	A.3		Industrial services for builders' carpentry and joinery of metal
28.21.11	A.1.27	A.2.2	Reservoirs, tanks, vats and similar containers, of metal, > 300 l
28.21.12	A.1.		Containers for compressed or liquefied gas, of metal
28.21.91	A.3		Installation services of tanks, reservoirs and containers, of metal (other than for building heating)
28.21.92	A.3		Repair and maintenance services of tanks, reservoirs and containers of metal (other than for building heating)
28.21.99	A.3		Industrial services for tanks, reservoirs and containers of metal
28.22.11	C.5		Radiators for central heating, not electrically heated, of iron or steel
28.22.12	A.1.		Boilers for central heating
28.22.13	A.1.		Parts of boilers for central heating
28.22.91	A.3		Installation services of central heating boilers
28.22.92	A.3		Repair and maintenance services of central heating boilers
28.22.99	A.3		Industrial services for central heating radiators and boilers
28.30.11	C.1.5		Steam or other vapour generating boilers; super-heated water boilers
28.30.12	C.1.5		Auxiliary plant for use with boilers; condensers for steam or other vapour power units
28.30.13	C.1.5		Parts of steam generators
28.30.91	C.3.5		Installation services of steam generators, except central heating hot water boilers, including installation services for metal pipe systems in industrial plants
28.30.92	C.3.5		Repair and maintenance services of steam generators (except central heating hot water boilers) and of systems of metal pipes in industrial plants
28.30.99	C.3.5		Industrial services for steam generators, except central heating hot water boilers
28.62.10	C.1.8		Hand tools of a kind used in agriculture, horticulture or forestry

CPA_code	EI_code1	EI_code2	Description
28.71.11	A.1.27		Tanks, casks, drums, cans, boxes and similar containers, for any material (excluding gas), of iron or steel, of a capacity > 50 l but ≤□300 l
28.71.12	A.1.27		Tanks, casks, drums, cans (except those to be closed by soldering or crimping), boxes and similar containers, for any material (excluding gas), of iron or steel, of a capacity < 50 l
28.71.90	A.3.27		Installation, repair and maintenance services of iron or steel boxes of a capacity not exceeding 300 litres
28.71.99	A.3.27		Industrial services for steel drums and similar containers
28.72.11	A.1.27		Cans, of iron or steel, to be closed by soldering or crimping, of a capacity < 50 l
28.72.12	A.2.27		Aluminium casks, drums, cans, boxes and similar containers, for any material (excluding gas), of a capacity ≤□300 l
28.73.13	A.1		Cloth, grills, netting and fencing, of iron, steel or copper wire; expanded metal, of iron, steel or copper
28.75.25	A.1.3		Hooks
28.75.27	A.1.		Other articles of base metal n.e.c.
29.11.21	A.2.27		Steam turbines and other vapour turbines
29.11.22	A.1.27		Hydraulic turbines and water wheels
29.11.23	A.1.27		Gas turbines, other than turbo-jets and turbo-propellers
29.11.31	A.1.27		Parts of steam and other vapour turbines
29.11.32	A.1.27		Parts of hydraulic turbines, water wheels including regulators
29.11.33	A.1.27		Parts of gas turbines, excluding turbo-jets and turbo-propellers
29.11.92	A.2.27		Maintenance and repair services of engines and turbines, except aircraft, vehicle and cycle engines
29.12.11	A.1.61		Linear acting (cylinders) hydraulic and pneumatic power engines and motors
29.12.12	A.1.61		Other hydraulic and pneumatic power engines and motors
29.12.21	A.1.29	A.1.37	Pumps for fuel, lubricants, cooling-medium and concrete
29.12.22	A.1.29		Other reciprocating positive displacement pumps for liquids
29.12.23	A.1.29		Other rotary positive displacement pumps for liquids
29.12.24	A.1.29		Other centrifugal pumps for liquids; other pumps; liquid elevators
29.12.31	A.1.11		Vacuum pumps
29.12.33	A.1.11	A.1.21	Compressors for refrigeration equipment
29.12.34	A.1.11	A.1.21	Air compressors mounted on a wheeled chassis for towing
29.12.35	A.1.21	A.1.21	Turbo-compressors
29.12.36	A.1.21	A.1.21	Reciprocating displacement compressors
29.12.37	A.1.11	A.1.21	Rotary displacement compressors, single-shaft or multi-shaft

CPA_code	EI_code1	EI_code2	Description
29.12.38	A.1.11	A.1.21	Compressors for use in civil aircraft and other compressors
29.12.41	A.1.61		Parts of hydraulic and pneumatic power engines and motors
29.12.42	A.1.11		Parts of pumps; parts of liquid elevators
29.12.43	A.1.11		Parts of air or vacuum pumps, of air or gas compressors, of fans, of hoods
29.12.9	A.3.21		Installation, maintenance and repair services of pumps and compressors
29.13.11	A.1.29		Pressure-reducing, control, check and safety valves
29.13.12	A.1.29		Taps, cocks, valves for sinks, wash basins, bidets, water cisterns bath and similar fixtures; central heating radiator valves
29.13.13	A.1.29		Process control valves, gate valves, globe valves and other valves
29.13.9	A.3.29		Installation, repair and maintenance services of taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like of metal
29.21.11	A.1.16	A.2.27	Furnace burners; mechanical stokers and grates; mechanical ash dischargers and the like
29.21.12	A.1.16	A.1.27	Industrial or laboratory furnaces and ovens, non-electric, including incinerators, but excluding bakery ovens
29.21.13	A.1		Industrial or laboratory electric furnaces and ovens; induction or dielectric heating equipment
29.21.14	A.1.16	A.2.27	Parts of furnace burners, furnaces and ovens
29.22.17	A.1.3		Pneumatic and other continuous action elevators and conveyors, for goods or materials
29.22.18	A.1.32		Other lifting, handling, loading or unloading machinery
29.22.19	A.1.3		Parts of lifting and handling equipment
29.22.92	A.2.32		Maintenance and repair services of lifting and handling equipment
29.23.11	A.1.15	C.1	Heat exchange units and machinery for liquefying air or other gases
29.23.12	C.1		Air conditioning machines
29.23.13	C.1		Refrigeration and freezing equipment and heat pumps, except household type equipment
29.23.14	A.1.12	A.1.13	Machinery and apparatus for filtering or purifying gases n.e.c.
29.23.30	C.1.5		Parts of refrigeration and freezing equipment and heat pumps
29.23.9	C.3.5		Installation, maintenance and repair services of non-domestic cooling and ventilation equipment
29.24.11	C.1.5		Producer gas or water gas generators; acetylene gas generators and the like; distilling or rectifying plant
29.24.12	A.1.22	A.1.25	Filtering or purifying machinery and apparatus, for liquid
29.24.21	A.1.36		Machinery for cleaning, filling, packing or wrapping bottles or other containers
29.24.23	A.1.27		Weighing machinery n.e.c.
29.24.24	A.1.42		Fire extinguishers, spray guns, steam or sand blasting machines and similar mechanical appliances except for use in agriculture

CPA_code	EI_code1	EI_code2	Description
29.24.31	A.1.25		Centrifuges n.e.c.
29.24.40	A.1.15	B.1.11	Machinery n.e.c. for the treatment of materials by a process involving a change of temperature
29.24.52	A.1.		Parts of centrifuges; parts of filtering or purifying machinery and apparatus for liquids or gases
29.24.53	A.1.17		Parts of calendering or other rolling machines; parts of spraying machinery, weights for weighing machines
29.24.91	A.3.25		Installation services of other general purpose machinery n.e.c.
29.24.92	A.3.25		Maintenance and repair services of other general purpose machinery n.e.c
29.32.1	A.1.36		Agricultural and forestry machinery for soil preparation or cultivation
29.32.40	A.1.17		Machinery for projecting, dispersing or spraying liquids or powders for agriculture or horticulture
29.32.65	A.1.29		Agricultural, horticultural, forestry, poultry- or bee-keeping machinery n.e.c.
29.42.11	A.1.31	B.1	Machine tools for working any material by removal of material by laser, ultrasonic and the like
29.42.35	A.1.31		Machine tools n.e.c. for working metal, sintered metal carbides or cermets, without removing material
29.51.11	A.1.12		Converters, ladles, ingot moulds and casting machines; metal-rolling mills
29.52.12	A.1.36		Coal or rock cutters and tunnelling machinery; other boring and sinking machinery
29.52.30	A.1.36		Other excavating machinery
29.52.40	A.1.36	A.1.35	Machinery for sorting, grinding, mixing and similar treatment of earth, stone, ores and other mineral substances; foundry moulds forming machinery
29.52.61	A.1.36		Parts for boring or sinking or excavating machinery; parts of cranes
29.52.62	A.1.36		Parts of machinery for sorting, grinding or other treatment of earth, stone and the like
29.54.11	A.1.2		Machines for extruding, drawing, texturing or cutting man-made textile materials; machines for preparing textile fibres
29.56.25	A.1.36		Special purpose machinery n.e.c.
29.56.26	A.1		Parts of other special purpose machinery
29.71.26	A.1.31	A.1.42	Electric space heating apparatus and electric soil heating apparatus
29.71.9	A.3.31		Installation, repair and maintenance services of professional electric appliances of 29.71
29.72.13	C.1.5	C.1.1	Air heaters or hot air distributors n.e.c., of iron or steel, non-electric
29.72.14	C.1.5		Water heaters, instantaneous or storage, non-electric
30.02.9	A.3.8		Installation services of computers and other data processing equipment
31.10.50	A.1.2		Ballasts for discharge lamps or tubes; static converters; other inductors
31.10.62	A.1.7		Parts of transformers, inductors and static converters
31.20.27	C.1		Plugs

CPA_code	EI_code1	EI_code2	Description
31.40.24	A.1.15		Parts of electric accumulators including separators
31.50.15	C.1.5		Discharge lamps; ultra-violet or infra-red lamps; arc lamps
31.61.21	A.1.451		Sparking plugs; ignition magnetos; magneto-dynamos; magnetic flywheels; distributors; ignition coils
31.62.12	A.1.35		Permanent magnets; electromagnetic couplings, clutches and brakes; magnetic lifting heads; parts thereof
31.62.13	A.1.43		Electrical machines and apparatus having individual functions
31.62.92	A.3.42		Maintenance and repair services of other electrical equipment n.e.c.
32.10.52	C.1.4		Semiconductor devices; light-emitting diodes; mounted piezo-electric crystals; parts thereof
32.10.92	C.2.4		Services connected with manufacturing of electronic integrated circuits
33.20.41	A.1.61		Instruments and apparatus for measuring or detecting ionizing radiations
33.20.51	A.1.61		Hydrometers, thermometers, pyrometers, barometers, hygrometers and psychrometers
33.20.52	A.1.29	A.1.61	Instruments for measuring or checking the flow, level, pressure or other variables of liquids and gases
33.20.53	A.1.61	A.1.43	Instruments and apparatus for physical or chemical analysis n.e.c
33.20.63	C.1.5	A.1.61	Gas, liquid or electricity supply or production meters
33.20.65	A.1.61		Measuring or checking instruments, appliances and machines n.e.c.
33.20.70	A.1.61	C.1.5	Thermostats, manostats and other automatic regulating or controlling instruments and apparatus
33.20.81	A.1.61		Parts and accessories for the goods of 33.20.1, 33.20.32, 33.20.33, 33.20.4, 33.20.5, 33.20.62 and 33.20.65; parts n.e.c.
33.20.82	A.1.61		Parts and accessories of microscopes (other than optical) and of diffraction apparatus
33.20.84	A.1.61		Parts and accessories of instruments and apparatus of 33.20.7
33.20.9	A.3.61	A.2.61	Installation, maintenance and repair services of instruments and apparatus for measuring, checking, testing, navigating and other purposes
33.30.10	A.1.63		Design and assembly services of industrial process control equipment, also for automated production plants
33.30.9	A.2.63		Repair and maintenance services of industrial process control equipment
33.40.23	A.1.31	A.1.42	Liquid crystal devices; lasers, except laser diodes; other optical appliances and instruments n.e.c.
33.40.24	A.1.61		Parts and accessories of other optical instruments
33.40.9	A.3.61		Installation, repair and maintenance services of professional photographic, cinematographic and optical instruments
34.10.41	A.1.33		Goods vehicles
34.10.51	A.1.33		Dumpers for off-highway use
34.10.54	A.1.33		Special purpose motor vehicles n.e.c.

CPA_code	EI_code1	EI_code2	Description
34.20.21	A.1.33		Containers specially designed for carriage by one or more modes of transport
34.20.70	A.1.51		Reconditioning, assembly, fitting out and bodywork services of motor vehicles
34.30.11	A.1.51		Parts for spark-ignition internal combustion engines, excluding parts for aircraft engines
34.30.12	A.1.51		Parts for other engines n.e.c.
34.30.20	A.1.51		Other parts and accessories n.e.c., for motor vehicles
35.30.12	C.1.42		Turbo-jets and turbo-propellers
36.62.1	A.1.32		Brooms and brushes
36.62.9	A.2.32		Industrial services for brooms and brushes
37.10.10	C.1.32		Metal secondary raw materials
37.20.10	C.1.32		Non-metal secondary raw materials
41.00.11	A.1.2		Drinking water
41.00.12	A.1.2		Non-drinking water
45.11.2	A.1.36		Excavating and earthmoving work
45.12.10	A.1.6		Test drilling and boring work
45.21.11	A.1		General construction work for one- and two-dwelling buildings
45.21.12	A.1		General construction work for multi-dwelling buildings
45.21.13	A.1		General construction work for warehouses and industrial buildings
45.21.14	A.1.		General construction work for commercial buildings
45.21.15	A.1.		General construction work for other buildings
45.21.31	C.1.5		General construction work for long-distance pipelines for oil and gas
45.21.32	C.1.5		General construction work for other long-distance pipelines, including for water
45.21.41	A.1.2		General construction work for local water and sewage pipelines, including ancillary works
45.23.12	A.1.54		General surface work for motorways, roads, streets and other vehicular or pedestrian ways
45.24.13	A.1.2		General construction work of locks, floodgates and other hydro-mechanical structures
45.24.14	A.1.3	A.1.2	Dredging work; other water-associated work
45.25.62	A.1.2		Other special trade construction work n.e.c.
45.31.42	C.3.4		Electrical installation work of heating and other electrical equipment, including electric solar energy collectors, of buildings
45.32.11	C.3.5		Thermal insulation work
45.32.12	C.3.5		Other insulation work

CPA_code	EI_code1	EI_code2	Description
50.10.11	A.1.33		Wholesale trade services of lorries, trucks, trailers, semi-trailers and buses
50.30.12	A.1.3		Wholesale trade services of other parts and accessories of motor vehicles
51.47.37	A.2.3		Wholesale trade services of miscellaneous consumer goods n.e.c.
51.56.12	A.2.2	A.2.3	Wholesale trade services of textile fibres
51.65.12	A.2.6		Wholesale trade services of machinery and equipment related supplies
51.65.15	A.2.6		Wholesale trade services of professional electrical and electronic machinery
51.65.16	A.2.6		Wholesale trade services of other general and special purpose machinery
51.66.11	C.2.8		Wholesale trade services of agricultural tractors
51.66.12	C.2.8		Wholesale trade services of agricultural and forestry machinery (excluding tractors) and of accessories and implements
51.51.11	C.2.5		Wholesale trade services of solid fuels
51.51.12	C.2.5		Wholesale trade services of motor spirit, including aviation spirit
51.51.13	C.2.5		Wholesale trade services of other liquid and gaseous fuels and related products
51.54.12	C.2.5		Wholesale trade services of plumbing and heating equipment and supplies
51.55.13	A.2.4		Wholesale trade services of other industrial chemicals
51.57.10	A.1.33		Wholesale trade services of waste and scrap
52.48.31	A.2.3		Retail trade services of cleaning materials
60.24.14	A.2.3		Transportation by vehicles for containerized freight
60.24.16	A.2.3		Transportation by vehicles for dry bulk goods
60.24.17	A.2.3		Transportation services by specialized vehicles, n.e.c.
60.24.2	A.2.3		.Freight transportation services by non-specialized road vehicles
63.11.11	A.3.31		Container handling services
63.11.12	A.3.31		Other cargo handling services
64.20.14	A.2.6	A.2.8	Shared business network services
64.20.15	A.2.6	A.2.8	Dedicated business network services
64.20.16	A.2.6	A.2.8	Data network services
73.10.11	A.2		Research and experimental development services on physical sciences
73.10.12	A.2		Research and experimental development services on chemistry and biology
73.10.13	A.2		Research and experimental development services on engineering and technology
73.10.14	A.2		Research and experimental development services on agricultural sciences

CPA_code	EI_code1	EI_code2	Description
73.10.15	A.2		Research and experimental development services on medical sciences and pharmacy
73.10.16	A.2		Research and experimental development services on other natural sciences
71.31.10	A.2	C.2.8	Leasing or rental services of agricultural machinery and equipment without operator
71.32.10	A.2	A.2.61	Leasing or rental services of construction and civil engineering machinery and equipment without operator
74.12.14	A.2		Other accounting services
74.12.2	A.2.		Book-keeping services, except tax returns
74.14.2	A.2.		Other management-related services
74.20.23	A.2.		Other architectural services
74.20.31	A.2.		Technical advisory and consultative services
74.20.34	A.2.		Engineering design services for the construction of civil engineering works
74.20.35	B.2.1		Engineering design services for industrial process and production
74.20.36	B.2.1		Engineering design services n.e.c.
74.20.52	A.2.8		Landscape architectural services
74.20.60	A.2.5		Project management services related to constructions and civil engineering works
74.20.71	A.2.4		Geological, geophysical and other scientific prospecting services
74.20.72	A.2.4		Subsurface surveying services
74.20.73	A.2.4		Surface surveying services
74.20.75	A.2.		Technical consultancy services other than engineering consultancy
74.30.11	A.2.		Composition and purity testing and analysis services
74.30.12	A.2.		Testing and analysis services of physical properties
74.30.13	A.2.		Testing and analysis services of integrated mechanical and electrical systems
74.30.15	A.2		Other technical inspection services
74.30.16	A.2.		Other technical testing and analysis services
74.70.11	A.2.3		Disinfecting and exterminating services
74.70.14	A.1.43		Specialized cleaning services
74.70.16	A.2.3		Other cleaning services
74.82.10	A.2.3		Packaging services
74.87.1	A.2.6		Other business services

CPA_code	EI_code1	EI_code2	Description
75.11.13	A.2.6	A.2.7	Overall economic and social planning and statistical services
75.11.14	A.2.6	A.2.7	Government services to fundamental research
75.11.15	A.2.6	A.2.7	Other administrative services of the government n.e.c.
75.12.1	A.2.6	A.2.7	Administrative services for the regulation of agencies that provide health care, education, cultural services and other social services excluding social security
75.13.11	A.2.6	A.2.7	Administrative agriculture-, forestry-, fishing- and hunting-related services
75.13.12	A.2.6	A.2.7	Administrative fuel- and energy-related services
75.13.13	A.2.6	A.2.7	Administrative mining- and mineral resources-, manufacturing- and construction-related services
75.13.17	A.2.6	A.2.7	Administrative multipurpose development project services
75.13.18	A.2.6	A.2.7	General administrative economic, commercial and labour affairs-related services
75.14.11	A.2.6	A.2.7	General personnel services for the government
75.14.12	A.2.6	A.2.7	Other general services for the government n.e.c.
80.30.1	A.2.9		Higher education services
80.42.1	A.2.9		Adult education services n.e.c.
80.42.10	A.2.9		Adult education services n.e.c.
80.42.2	A.2.9		Other education services
90.01.11	A.1		Sewage removal and treatment services
90.01.12	A.2.2		Treatment services of cesspools and septic tanks
90.02.11	A.1		Refuse collecting services
90.02.12	A.1		Refuse incineration services
90.02.13	A.1		Other disposal services of refuse
90.02.14	A.1		Special refuse treatment services
90.03.11	A.1.43		Remediation and clean-up of soil and groundwater services
90.03.12	A.1.43		Clean-up services of polluted surface water
90.03.13	A.1		Sanitation and similar services
92.53.11	C.8		Botanical and zoological garden services
92.53.12	C.1		Nature reserves services, including wildlife preservation services

Note: Many of the products in this list are not environmental products *per se*. They can potentially be used for environmental purposes. Whether or not these products are of an environmental nature is determined by the use which is made of them. An estimate of the size of the environment industry based on this list of products will therefore most probably generate an overestimation. It results in the potential size of the environment industry when all the potentially environmental products would effectively be used for environmental purposes.

ANNEX 2: BIBLIOGRAPHY

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