Environment and labour force skills

Overview of the links between the skills profile of the labour force and environmental factors

Final report

Client: European Commission DG Environment

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Executive Summary

The skills profile of green jobs needs to be understood. This is an important sector, with its broadest definition, it touches on up to 21 million jobs in Europe are linked to the environment. Green jobs are broadly "jobs in the environmental sector and/or jobs requiring specific environment-related skills". The majority of these are in activities depending on or using natural resources rather than employment in environmental management (pollution and resource management). It is therefore a very valid question as to what are the skills profiles for these jobs, and how might skills needs change in the future.

The current skills profile. According to the OECD, the main characteristic of environmental job qualifications and skills is that they are traditional qualifications and skills applied to environmental issues. However, others believe that specific skills are needed for the Green Economy such as knowledge of sustainable materials, relevant traditional skills, "Carbon foot printing" skills and environmental impact assessment skills. Not surprisingly, given its size and variety, green jobs cover all sorts of skill needs (including low and high skilled).

Skills data is poor. Apart from a few sectors where a small amount of data is available, data on skills profiles in the green economy is scarce. For the economy as a whole, it is known that, due to technological progress, the demand for low-skill workers has decreased and the demand and rewards for higher-skill workers have increased.

The skills profile will change as green jobs will change. The sector is changing, and perhaps faster than most others. In terms of future employment in green jobs, employment will be affected in at least four ways:

1. Additional jobs will be created in several areas, such as in the manufacturing of pollution-control devices which are added to existing production equipment;
2. Substitution of employment will take place, for example due to shifting from fossil fuels to renewable energy sources, from truck manufacturing to rail car manufacturing, or from land filling and waste incineration to recycling;
3. Particular jobs may be eliminated without direct substitution (e.g. when the use of certain packaging materials is discouraged or forbidden and an end are put to their production).
4. Many existing jobs (i.e. plumbers, electricians, metal workers, and construction workers) may be altered due to the greening of day-to-day skill sets, work methods and profiles.

Changing skill-needs need to be better forecast. The call for Europe to put more effort in anticipating changing skill-needs is emphasized by the re-launched Lisbon strategy as well as by other policy documents. UNEP and the ILO states that the transition to a green economy will create demand for workers and that there is clear proof that a high share of future green jobs will be high skilled (and thus well paid). It is believed that training programmes will be needed to fill the new positions. Identifying the required skills needed for green jobs may increase the capacity to combat climate change. Investment in skills is also needed (or may result in – it can vary as to which comes first) to make the most of sustainable production and consumption and new environmental technologies, both of which may promote high-skill jobs at the expense of low-quality jobs.

Risk of shift to low skills work. The ETUC though draws attention to a different change, which is the risk that unless the transition is properly managed then jobs in new enterprises favoured by climate policies will be less well-paid and enjoy less secure conditions of employment than in established branches.

Skills pay off through improved productivity. Better skills are essential for European economies as they make it easier to innovate, adopt new technologies, attract investment and compete in new markets. This consequently increases job growth and productivity.

Skill shortages are a threat for the green expansion. A number of sectors already face shortages. For example, the Directive on Energy Efficiency of Buildings which promotes combined environmental and training measures. According to several national trade unions a shortage of skilled people exists, meaning that there will not be enough qualified workers to implement the Directive. Anecdotal evidence exists elsewhere.

Green skills can be developed. A way to solve these skills shortages is by engaging in life-long learning and vocational training, so that employees gain the skills needed to adjust to the changing economic conditions and job profiles. According to statistics from Eurostat, workers in environment-related sectors undertake relatively less life-long learning activities. Policy makers can though ensure that training for green skills is provided and indeed there are already a number of such schemes in place, although there is little information on their effects and on whether there are best practices to be copied.

Green jobs can lead to new skills. One question is whether new jobs in 'green' sectors leads to increased investment in the skills of these workers, and whether environmental schemes are a good way of creating employment for low-skilled workers. There are examples where demand for employees with environmental skills has to go hand-in-hand with (re)training schemes for workers. In other words, there have been success stories where environmental initiatives such as installing energy-efficient insulation in the U.K. housing sector has involved re-training, up-skilling and win-win situations. The research also showed that, as jobs are created at the local level, it is important to tie green skills to sustainable local economic development strategies.

Finally, the study provides some **potential areas for future research**.

1 Introduction

1.1 Background and rationale

The eco-industry and its context
Higher incomes and rising pollution levels have brought with them an increased demand for environmental protection (policies). One result of this is that the EU's eco-industry has an annual turnover of over €270 billion which equals more than 2% of the EU's Gross Domestic Product (GDP). The eco-industry's two most important sectors are pollution management (including technologies and services in waste management, air pollution control, soil remediation, and recycling) and resource management (including renewable energy plants and water supply).

Growth rates of most eco-industry markets have been strong over recent years and, consequently, the market outlook is favourable. This holds especially true for emerging markets in the new member states where there is a strong demand for environmental goods and services. Growth is now concentrated mainly in smaller resource management subsectors where new technologies such as solar and wind energy have made remarkable progress.

EU policy and Regulation
The Lisbon Strategy's continuing aspiration is for the EU to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion, by 2010[1]. The Strategy acknowledges that a more dynamic economy can help meet wider social and environmental aims; growth in terms of GDP and the number of jobs can go together with promoting social or environmental goals[2]. As sustainable development is critical for the achievement of environmental and social objectives, it is one of the key principles of all EU policies and actions[3]. Within the sustainable development agenda, climate change is of a high priority[4].

One of the ways of achieving the goals set by the Lisbon Strategy is environmental regulation. This form of regulation is one of the drivers of growth of eco-industries. More stringent environmental targets lead to demand for mitigation, prevention and reduction

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1 Website European Commission http://ec.europa.eu/employment_social/employment_strategy/index_en.htm#ees

2 EC (2005). Commission Staff Working Document on the links between employment policies and environment policies. http://ec.europa.eu/environment/integration/pdf/sec_2005_1530_en.pdf

3 Scott, J. (2008), E3G, Future Skill Needs for the Green Economy: Some Starting Points. http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-e3g_cedefop_070808.pdf and Rigg (2008), Skills for Sustainable Development: necessary but not sufficient? http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-presentation_rigg.pdf

4 International Labour Conference. 97th Session (2008). Skills for improved productivity. employment growth and development.

measures. Consequently, stringent environmental regulation will lead to an increased demand for eco-industrial products. In addition, there is demand for greener products and services from the production and consumption side, independent of environmental regulation. Indeed, recent analysis suggests that environmental regulation is only responsible for a fraction of jobs associated with the environment[5].

Labour force skills

It is often argued that having a highly skilled workforce helps to build individual motivation and improves the efficient delivery of services. This suggests that introducing environmentally relevant competencies into the workforce and mainstreaming these will have a similar effect. In addition, understanding what skills are necessary to make the transition to a greener economy is critical to achieving sustained growth in the environment-related sectors of the economy, and to tackling environmental problems.

Information availability and countries covered

This research gives an overview of:

- the employment in eco-industries
- the skills profiles of employees within eco-industries
- the direction of structural employment in the sector
- the current status and likely future trend of the demand for high and low skilled workers in the eco-industries
- the success of environmental schemes in terms of creating employment for both low skilled as well as high skilled workers
- evidence to suggest that environmental improvements have been made as result of an increase in the skills and competencies of a (re-)trained labour force
- the degree to which life-long learning activities are pursued by environmental employees in comparison to other sectors
- how likely it is that environmental skills and qualifications will become a normal attribute of employees regardless of the sector of employment (mainstreaming)

However, it should be noted here that the research is limited in that there is a significant lack of information. For example, limited information could be found on whether or not environmental improvements have been made as result of an increase in the skills and competencies of a (re-)trained labour force.

Besides covering the EU in this report, the research attempted to focus on six EU Member States: Germany, France, Italy, Poland, Spain and the UK. However, due to the unavailability of information this was not always possible. Wherever possible, information on these countries is given.

Since the environment-related sector is not a well defined sector of activity and since environmental skills are not necessarily distinct, different sources use different definitions

5 GHK et al. (2007). Links between the environment, economy and jobs. http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_report.pdf

(eco-industry, green economy etc). In this report, it was attempted to bring into play the various definitions used by different sources.

1.2 Outline of the report

This report is organized as follows:

- Chapter 2 presents the current and future environment-related structural employment trends.
- Chapter 3 describes the current and future skills profiles in environment-related industries.
- Chapter 4 explains the impact of environment policies and schemes on employment.
- Chapter 5 discusses the life-long learning activities of environmental employees.

2 Current and future environment-related structural employment trends

2.1 Introduction

There are strong links between the economy and the environment[6]. This can for example be seen from the fact that the eco-industry has become one of the biggest industrial sectors in Europe[7]. The eco-industry not only leads to a cleaner environment, but also contributes to economic growth and employment[8]. The employment in the EU eco-industry increased at 5 percent per year in the 1990s, which made the eco-industry one of the fastest growing sectors of the EU economy. Since 2000, the smaller but more dynamic sub-sectors (such as resource management subsectors) have been the source of net new employment. This was due to the extraordinary progress made in new technologies such as solar and wind energy. The size of the more established industries (e.g. pollution abatement) has remained quite constant as these industries met the increased demand by becoming more efficient[9].

This chapter gives an overview of the current and future employment in environment-related industries in the EU, before describing the current and future skills profiles in environment-related industries in chapter 3. In section 2.2 the different definitions of the eco-industry and the employment numbers linked to these definitions are described. Also, the employment in various environment-related economic activities in the EU and in the Member States is provided. This section is mainly based on the GHK report[10]. Future employment trends in the EU as a whole, but also in several specific environment-related sectors are described in section 2.2. Due to the unavailability of information, the section contains information on just a few environment-related sectors.

2.2 Current employment trends in environment - related industries

Broadest definition of eco-industries: turnover of €3 trillion and 21 million direct jobs

Various definitions for the eco-industry exist. The OECD/Eurostat definition for the eco-industry is all “activities which produce goods and services to measure, prevent, limit,

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6 GHK et al. (2007). Links between the environment, economy and jobs. http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_report.pdf

7 The two most important sectors in the industry are pollution management and resource management - Ernst & Young for European Commission DG Environment (2006). Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU

9 European Commission (2007), Facts and Figures, the links between EU´s economy and environment http://ec.europa.eu/environment/enveco/industry_employment/pdf/facts_and_figures.pdf

10 GHK et al. (2007). Links between the environment, economy and jobs. http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_report.pdf

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 resources." [11] The key statistics for this definition are as follows:

- The eco-industry has a turnover of € 270 billion in current prices (2006). This corresponds with 1.4% of total EU turnover;
- The number of people directly employed in the eco-industry is 2.3 million (1% of the European workforce);
- When induced and indirect effects are included, the eco-industry has a turnover of € 750 billion and provides 4.6 million jobs[12].

This OECD/Eurostat definition is also used in the study of Ernst & Young. According to this study, the total estimated employment in the eco-industry is as follows (net FTEs):
- 1,845,000 direct jobs in pollution management (Solid Waste Management & Recycling, Waste Water Treatment, Air Pollution Control, General Public Administration, Private Environmental Management, Remediation & Clean Up of Soil & Groundwater, Noise & Vibration Control, Environmental Research & Development, Environmental Monitoring & Instrumentation;
- 500,000 indirect jobs in pollution management;
- 1,040,000 direct and indirect jobs in resource management (Water Supply, Recycled Materials, Renewable Energy Production, Nature Protection, Eco-construction)[13].

This study states thus that the total direct and indirect employment due to eco-industries represents approximately 3.4 million full-time job equivalents of which 2.3 million jobs come from pollution management activities[14].

However, the links between the economy and the environment exceed the narrow definition of eco-industries traditionally taken, as many sectors are supported by a good quality environment[15].

A study by GHK includes all the links between the economy and the environment and therefore covers a much broader range of environment related economic activities. The types of economic activities covered are as follows:
1. Activities where the environment is used as a primary natural resource or input – e.g. agriculture, forestry, mining, electricity generation and water supply.
2. Activities relating to the protection and management of the environment – e.g. waste recycling, pollution & sewage control and environmental management.
3. Activities reliant on environmental quality – e.g. environment related tourism.

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11 Ernst & Young for European Commission DG Environment (2006). Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU

12 GHK et al. (2007). Links between the environment, economy and jobs. http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_report.pdf

13 Ernst & Young for European Commission DG Environment (2006). Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU

14 DG Environment 2006 "Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU".

15 GHK et al. (2007). Links between the environment, economy and jobs. http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_report.pdf

As these classifications are more subjective than the narrow OECD/Eurostat definition, GHK uses both a core definition and a broad definition. The core definition contains economic activities based solely on natural resources such as organic agriculture, sustainable forestry, renewable energy and water extraction and supply. If this core natural resource definition is applied and the environmental protection and management and environmental quality sectors, the total turnover in the environment related economy in Europe is €405 billion and it provides 4.4 million jobs. The broad definition consists of all agriculture and forestry, fishing, mining and quarrying as well as all electricity generation and water supply and extraction. Based on this definition, the total direct turnover is €3 trillion and the total number of direct jobs amounts to 21 million[16]. An overview of the numbers linked to the different definitions is presented in the table 2.1.

Table 2.1 Employment and total turnover in eco-industries in the EU – various definitions

	Employment	Total turnover
Narrow definition eco-industries (mainly pollution prevention or treatment)	2.3 million	€ 270 billion
+ activities closely dependent on a good quality environment (environment-related tourism, organic agriculture, renewable energy etc)	4.4 million	€ 405 billion
+ induced 'knock-on' or 'multiplier' effects	8.6 million	€ 1 trillion
Widest definition- includes all activities dependent on the environment (all agriculture, renewable energy etc)	21 million	€ 3 trillion

Source: Website of the EC – Environment and employment: http://ec.europa.eu/environment/integration/employment_en.htm

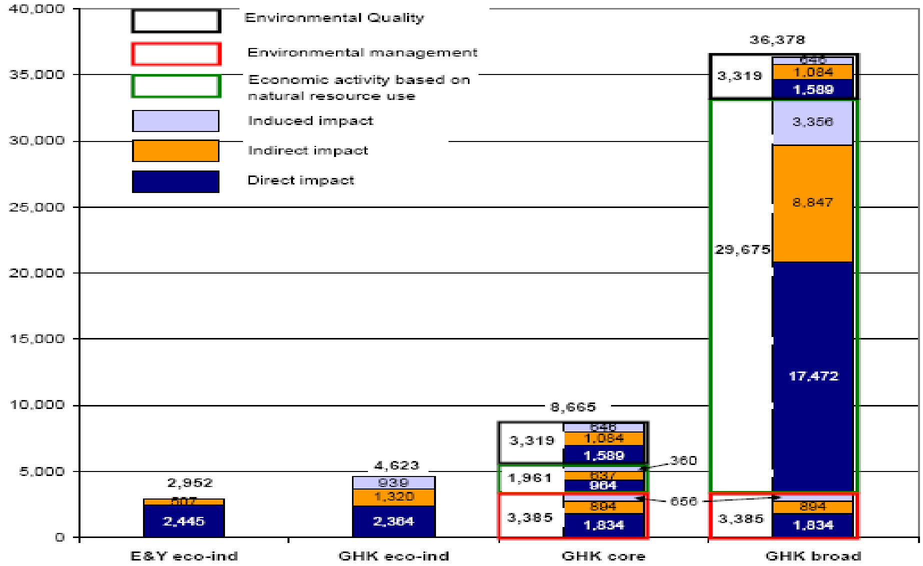
Using the widest definition, about 10 percent of the jobs in the EU are somehow linked to the environment. When the indirect effects are included this share increases to 16.7 percent[17], meaning one in six jobs in the EU are in some way linked to the environment.

Figure 2.1 illustrates the total employment in the eco-industry in Europe according to the E&Y and GHK studies. There are big differences between the figures of the two reports. A broader definition naturally leads to bigger numbers. Furthermore, there is also a 'shades of green'-issue here, as applying a wider definition leads to a fall in the importance of the environment relative to other contributory factors.

16 GHK et al. (2007). Links between the environment, economy and jobs. http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_report.pdf

17 Website of the EC – Environment and employment: http://ec.europa.eu/environment/integration/employment_en.htm

Figure 2.1 Employment by environment related economic activity, FTE '000s (2000)



Source: GHK et al. (2007). Links between the environment, economy and jobs.

2.2.1 Employment in various environment- related activities

Table 2.3 shows the employment in more detail for various environment related activities ('000 full-time equivalents) for the EU-27 in 2000. As the table shows, total employment in economic activities based on natural resources is much higher than employment in environmental management (pollution and resource management) and environment quality (the share of these activities is shown in figure 2.2). It can be seen that direct employment is higher than indirect and induced employment for all the activities except for mining, extraction, and quarrying, non-renewable electricity generation and noise and vibration control.

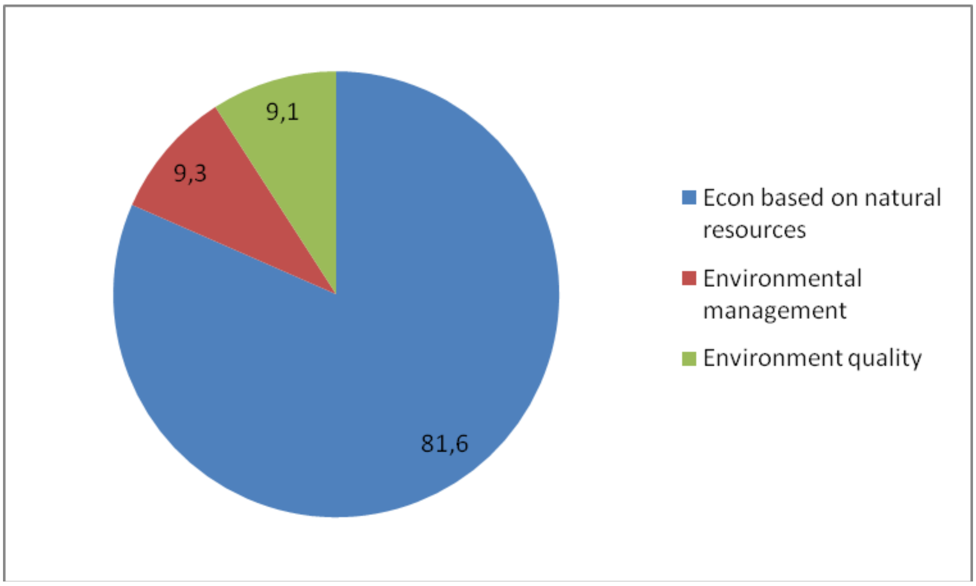
Table 2.2 Employment ('000 full-time equivalent) in Environment- related Activities, EU27, 2000

		Direct	Indirect	Induced	Total
A	**Econ based on Natural resources**	**17,472**	**8,847**	**3,356**	**29,675**
i	Agriculture (non-organic)	13,970	4,630	1,189	19,788
ii	Organic farming	300	151	48	499
iii	Forestry (other)	405	124	67	595
iv	Sustainable forestry	133	61	30	224
v	Fishing (except recreation, which is covered under tourism)	247	85	47	379
vi	Mining, extraction and quarrying	901	1,082	607	2,591
vii	Non-renewable Electricity generation	985	2,289	1,086	4,360
viii	Renewable electricity	131	121	101	353
ix	Water extraction and supply	399	304	182	886
B	**Environmental Management**	**1,834**	**894**	**656**	**3,385**
B1	**Pollution management**	**1,544**	**656**	**524**	**2,723**
i	Solid Waste Management & Recycling (SWM)	846	342	260	1,449
ii	Waste Water Treatment (WWT)	428	173	132	733
iii	Air Pollution Control (APC)	39	45	31	116
iv	General Public Administration (GPA)	104	31	48	182
v	Private Environmental Management (PEM)	82	30	29	142
vi	Remediation & Clean Up of Soil & Groundwater (RCSG)	22	9	7	38
vii	Noise & Vibration Control (NVC)	21	25	17	63
viii	Environmental Research & Development (ERD)	n/a	n/a	n/a	n/a
ix	Environmental Monitoring & Instrumentation (EMI)	n/a	n/a	n/a	n/a
B2	**Resource management**	**291**	**239**	**133**	**662**
i	Recycled materials**	223	211	112	546
ii	Nature protection**	68	28	21	116
C	**Environment Quality**				
i	Environment related Tourism	1,589	1,084	646	3,319
	Total	**20,894**	**10,826**	**4,658**	**36,378**

** EU15

Source: GHK et al. (2007). Links between the environment, economy and jobs.

Figure 2.2 The share of the main environment related activities (2000)



Source: ECORYS figure based on the GHK (2007), Links between the environment, economy and jobs

2.2.2 Employment in environment related activities by Member State

Table 2.3 shows the total employment (fte) in environment related activities per Member State in 2000. As the table illustrates, there are big differences in employment in environment related activities between the Member States. The total employment in environment related activities was the lowest in Malta and Luxembourg (respectively 14,000 and 16,000). The highest employment is found in Romania, Poland, Germany, France and the UK (respectively 5,867; 5,759; 3,651; 3,034; 2,776 in thousands).

Table 2.3 Total employment, ('000s), by broad environment related class, by Member State, fte

	Econ based on Natural resources	Environmental Management		Environment Quality	Total (exc. main env. primary sectors)
	Core	Pollution management	Resource management		
EU-27	1,961	2,723	662	3,319	8,665
Belgium	10	36	31	49	126
Denmark	15	70	19	33	136
Germany	310	550	111	501	1,472
Greece	17	14	12	65	108
Spain	92	95	20	298	505
France	221	432	180	313	1,146
Ireland	7	11	3	23	43
Italy	185	78	44	297	605
Luxembourg	1	2	2	4	9
Netherlands	26	175	10	105	316
Austria	91	132	5	68	296
Portugal	72	30	15	71	188
Finland	44	16	1	28	89
Sweden	59	29	10	50	149
UK	154	196	112	543	1,004
Czech Republic	89	3	0	59	152
Estonia	8	12	0	10	31
Cyprus	1	1	0	8	9
Latvia	26	9	0	16	51
Lithuania	7	7	0	12	26
Hungary	44	85	0	42	171
Malta	0	2	0	3	6
Poland	161	293	0	123	577
Slovenia	11	24	0	12	47
Slovakia	32	40	0	21	93
Bulgaria	82	44	0	39	165
Romania	133	221	0	68	423

	Econ based on Natural resources	Total (exc. main env. primary sectors)	Total employment
	Broad (exc. Core)		
EU-27	27,713	8,665	36,378
Belgium	191	126	318
Denmark	203	136	338
Germany	2,179	1,472	3,651
Greece	875	108	983
Spain	1,708	505	2,213
France	1,888	1,146	3,034
Ireland	175	43	218
Italy	1,481	605	2,086
Luxembourg	7	9	16
Netherlands	546	316	862
Austria	663	296	959
Portugal	651	188	838
Finland	232	89	321
Sweden	175	149	324
UK	1,772	1,004	2,776
Czech Republic	617	152	769
Estonia	113	31	144
Cyprus	24	9	33
Latvia	223	51	275
Lithuania	396	26	422
Hungary	547	171	717
Malta	9	6	14
Poland	5,182	577	5,759
Slovenia	168	47	215
Slovakia	295	93	387
Bulgaria	1,405	165	1,571
Romania	5,444	423	5,867

Source: GHK et al. (2007). Links between the environment, economy and jobs.

Environmental sectors and turnover of EU member states

The turnover of eco-industries as a percentage of GDP varies significantly between Member states. This share is highest in Denmark and Austria. There is little difference between old and new Member States[18].

The two largest producers of environmental technologies in the EU are Germany and France. Together they generate 49 percent of the EU's total turnover generated by environmental technologies. The ten new Member Sates' turnover is only 6 percent of the total EU-25 turnover on pollution management. This is broadly in line with the size of their economies.

18 Ernst & Young for European Commission DG Environment (2006). Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU

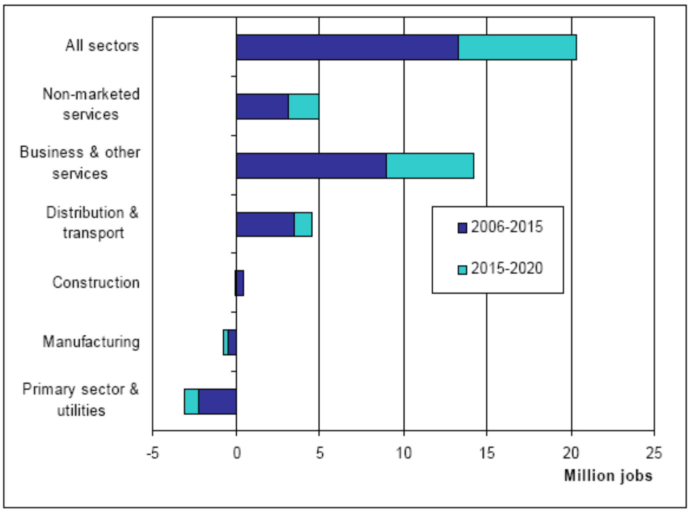
2.3 Future employment trends in environment - related industries

2.3.1 Future employment in Europe in general: 20.3 million additional jobs by 2020

Before describing the future employment trends in environment-related industries, the future employment in Europe in general will shortly be discussed. In Europe, a general shift has taken place away from the primary sector (agriculture, agribusiness, fishing, forestry and all mining and quarrying industries) and traditional manufacturing industries towards services in a knowledge-intensive economy. According to the forecast of CEDEFOP, this development is likely to continue in the future. This holds for both individual countries as well as for Europe as a whole[19].

However, even though there will be a loss of more than 3 million jobs in the primary sector and about 0.8 million in manufacturing, more than 20.3 million additional jobs are expected to be created between 2006 and 2020 in the EU-25+ (EU-25 plus Norway and Switzerland). Figure 2.3 shows the employment trends by broad sector for the EU-25+[20].

Figure 2.3 Employment trends by broad sector, change in millions, EU-25+



Source: CEDEFOP, 2008.

Even in areas where employment is projected to decrease, there will be large numbers of job openings because of replacement demand. The need to replace most of the people leaving (due to retirement or other reasons) more than offsets the losses in all areas. This is illustrated in figure 2.4[21]. As the figure shows, the expansion demand for skilled agricultural and fishery workers is negative, but the replacement demand is positive and

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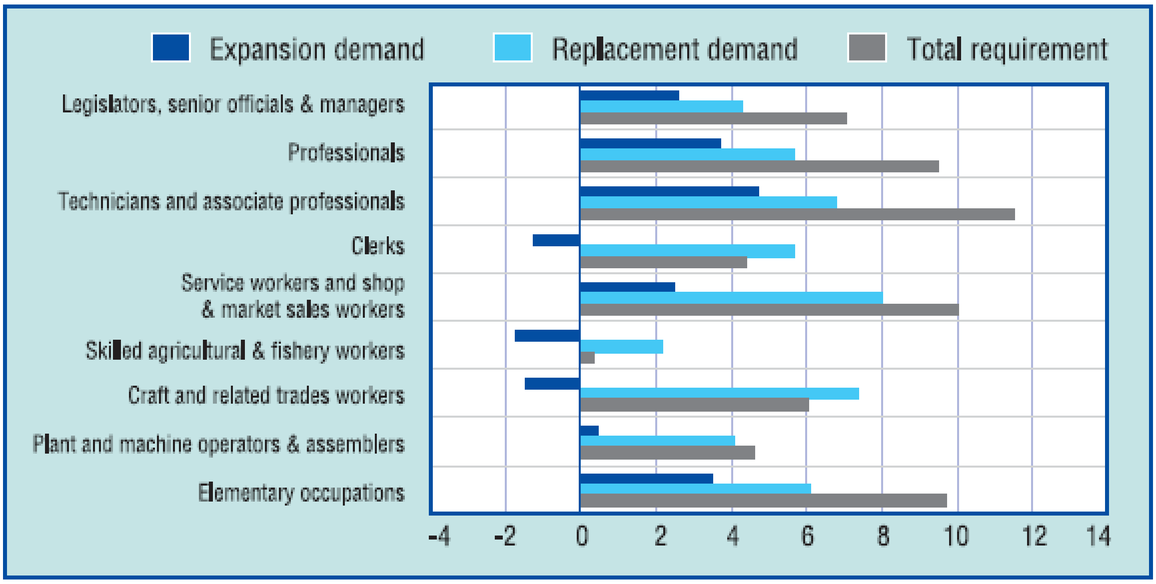
19 Cedefop (2008). Future Skill needs in Europe. Focus on 2020. http://www.trainingvillage.gr/etv/Upload/Information_resources/Bookshop/498/4080_en.pdf

20 Cedefop (2008). Future Skill needs in Europe. Focus on 2020. http://www.trainingvillage.gr/etv/Upload/Information_resources/Bookshop/498/4080_en.pdf

21 Cedefop (2008). Future Skill needs in Europe. Medium-term forecast.

http://www.skillsweb.eu/Portals/0/Future%20sjkills%20needs.pdf offsets the negative expansion demand. This makes the total requirement for skilled agricultural and fishery workers about 2.2 million in 2015.

Figure 2.4 Demand by occupation, broad groups (change in millions), 2006-15, EU-25, Norway and Switzerland



Source: CEDEFOP, 2008.

2.3.2 Future employment environment-related sectors: employment will be affected in 4 ways

According to a study by UNEP on green jobs, which are "jobs in the environmental sector and/or jobs requiring specific environment-related skills", green employment will be affected in at least four ways:
1. Additional jobs will be created in some areas, like in the manufacturing of pollution-control devices which are added to existing production equipment;
2. Substitution of some employment, like due to shifting from fossil fuels to renewable energy sources, or from truck manufacturing to rail car manufacturing, or from land filling and waste incineration to recycling;
3. Particular jobs may be eliminated without direct substitution, like in the situation that the use of certain packaging materials are discouraged or are forbidden and an end is put on their production.
4. Many existing jobs (i.e. plumbers, electricians, metal workers, and construction workers) may be altered due to the greening of day-to-day skill sets, work methods and profiles[22].

A report by the ETUC addresses a very different trend concerning future employment in environment-related sectors. It states that several involved parties believe jobs in new enterprises favoured by climate policies (in particular in renewable energies and energy services) to be less well-paid and enjoy less secure conditions of employment than in

22 UNEP et al. (2008). Green Jobs: Towards decent work in a sustainable low-carbon world http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_098503.pdf

established branches. However, the report notes that this is a trend which is not specific to environment-related sectors but which also concerns new sectors like ICT[23]. Since little relevant further information was found on this trend, more research might be useful in order to get more insights into this phenomenon.

Future employment in several environment-related sectors

Table 2.4 presents information on the future employment in several environment-related sectors. Please note that the information is not only on the EU, but sometimes also for the whole world.

Table 2.4 Future employment in environment related sectors

Buildings	Energy efficiency typically refers to reductions in energy demand that raise the ratio of benefit to cost—economic or environmental. Through its 'Action plan on Energy Efficiency' (2006) and its 'Energy Performance of Buildings Directive' (2003), the EU seeks to make buildings more energy efficient; thus, reduce energy demand in a way that has larger economic and environmental benefits than costs. Due to the rise in demand for green building components and energy-efficient equipment, green manufacturing jobs will increase. Consider for example the thermal refurbishment of buildings; if the highest energy standards are applied, the employment will be 1 million man-years by 2030 (10% of EU employment in the sector)
Cement	The shift towards energy-efficient plants is likely to create a number of construction jobs in the short term, but in the long run it will require fewer workers.
Electricity production and supply	Due to energy savings there will be small absolute job losses.
Renewable energy sources and efficiency-related components of the economy	Because of the shift towards clean energy production, employment in the renewable energies sector is expected to increase quickly. By 2010, the sector is expected to create up to 2 million additional jobs. These additional jobs will mainly be in manufacturing and installation. The 2006 renewable energy roadmap of the Commission states that there will be 650,000 jobs in the sector by 2020. Wind power development opens up employment opportunities in a range of fields (e.g. meteorologists and surveyors, people trained in anemometry, structural, electrical, and mechanical engineers to design turbines, generators etc.)

[23] ETUC (2007). Climate Change and employment. Impact on employment in the European Union-25 of climate change and CO2 emission reduction measures by 2030 http://www.tradeunionpress.eu/Web/EN/Activities/Environment/Studyclimatechange/rapport.

Table 2.4 Future employment in environment related sectors – Continued

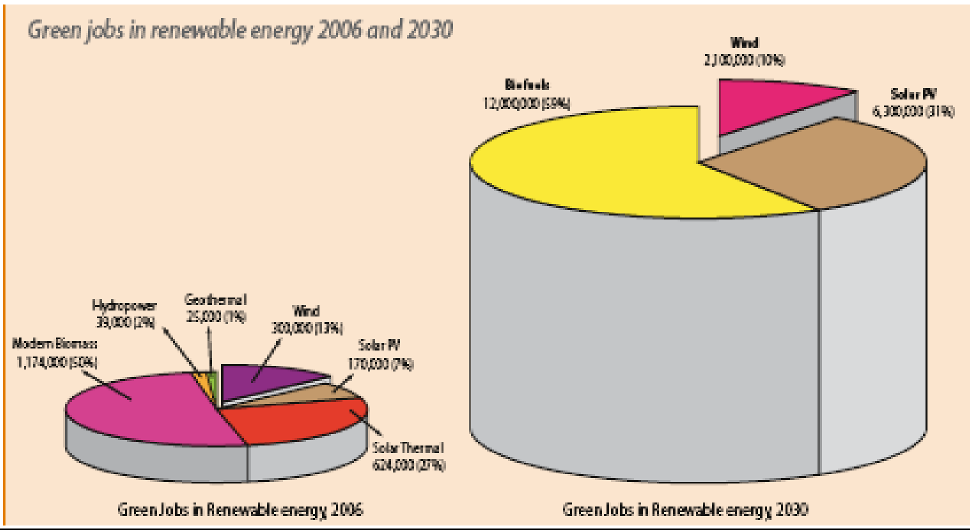
Transport	Employment linked directly and indirectly to railway and public transport systems will quadruple by 2030 (compared to BAU). Road freight transport will exist of 50% less jobs in 2030 (compared to BAU). The employment in the car industry is expected to remain stable between 2000 and 2030. This is subject to dissemination of clean technologies and increased value added.
Energy intensive industries (Iron and steel, cement, aluminium etc)	50.000 jobs out of 350.000 jobs could be lost.
Agriculture	Jobs for agricultural skilled workers, Clerks and craft and related trades workers will decrease.
Carbon capture and storage (CCS)	Many of the subsurface operations are likely to be operated by existing employment.
Climate change	Adapting to climate change could generate employment (e.g. new irrigation schemes in dry land farming have the potential to generate work).
Mining, fossil fuels, and smokestack industries	The people who lose their job are likely to be far outnumbered by the people who retain their job. Job losses will mainly occur in mining, fossil fuels, and smokestack industries.

Source: UNEP et al. (2008). Green Jobs: Towards decent work in a sustainable low-carbon world,
ETUC (2007). Climate Change and employment. Impact on employment in the European Union-25 of climate change and CO2 emission reduction measures by 2030,
Dupressoir (2008), Impact of climate change mitigation policies on employment in the EU, European Commission (2007), Facts and Figures, the links between EU's economy and environment, Scott, J. (2008), Future Skill Needs for the Green Economy: Some Starting Points, Cedefop (2008). Future Skill needs in Europe. Focus on 2020.

Employment in the renewable energy sector (in the world)

Relatively more detailed information is available on the future employment in the renewable energy sources sector. Figure 2.5 illustrates the share of green jobs in the renewable energy sector in the world in 2006 and 2030. As the figure shows, while in 2006 the share of jobs in Modern Biomass is the highest, in 2030 this is expected to be the case for jobs in biofuels.

Figure 2.5 The share of green jobs in the renewable energy sector in 2006 and 2030



Source: ILO (2008), Green jobs, Facts and Figures.

Employment in the renewable energy sector: US and Australia

Looking at the rest of the world, one can not discuss employment in the renewable energy sector and leave out recent US initiatives on this matter. In a nationwide movement, blue-collar jobs are getting a green update. New, more environmental technologies are supported by training the workforce to manufacture, install and maintain them. Consider the Green Jobs Act of 2007, which authorized $125 million per year to create a pilot Energy Efficiency and Renewable Energy Worker Training Program.

New initiatives concerning environment-related work are plentiful. These initiatives are believed to be inspired by forecasts of increases in the demand for energy. Combining these forecasts with recent legislative commitment and with the recent call for a lower dependence on foreign governments and natural disasters, seems to go some way in explaining the large number of new initiatives[24].

The American Solar Energy Society forecasts that 20 million more jobs could be created by 2030 as a consequence of the new energy economy[25]. Furthermore, 'Greener Pathways', a recent report from the Center on Wisconsin Strategy states that initiatives will have an even greater impact on the transformation of current industries and jobs[26].

Obama's presidency is likely to have a big influence on green policies and industries in the US. Obama has indicated his desire to strengthen energy security and create millions of new jobs in the process[27]. However, Renewable Energy World points out that many of Obama's comments were made prior to the economy's fall and that the incoming administration has subsequently acknowledged that its attention must focus initially on

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24 State Journal (2008) - **Green Jobs Will Require New Skills Among Workers** (http://www.statejournal.com/story.cfm?func=viewstory&storyid=37057)

25 American Solar Energy Society (2007) - Renewable Energy and Energy Efficiency: Economic Drivers for the 21st Century (http://www.ases.org/images/stories/ASES-JobsReport-Final.pdf)

26 Center on Wisconsin Strategy (2008) - Greener Pathways: Jobs and Workforce Development in the Clean Energy Economy (http://www.cows.org/pdf/rp-greenerpathways.pdf)

27 Green Chip Stocks – A changing of the energy guard (http://www.greenchipstocks.com/articles/obama-renewable-energy/301)

getting the economy healthy and secondarily on reducing greenhouse gas emissions to 80 percent below 1990 levels by 2050[28]. Therefore, to what extent and how the announced economy bailout plan and the so called 'Green New Deal' will affect environment-related industries remains to be seen.

A somewhat critical view on market transforming events due to global warming is taken in Australia. Despite mentioning that global warming and peak oil might just transform markets and organisations in Australia, one article argues that there are too little government incentives for businesses to invest in environmentally friendly production processes and develop renewable energy industries[29]. Furthermore, a report by the CSIRO suggests that growth in green jobs could be constrained by Australia's chronic skills shortages. According to the CSIRO, a skill set far broader than many think will be needed. Furthermore, it is stated that, before this skill gap is sorted out, the identification of available renewable energy business opportunities will not happen[30].

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28 Renewable Energy World – Obama's Green Economy (http://www.renewableenergyworld.com/rea/news/article/2008/12/obamas-green-economy-54326)

29 The Age Business Day – Skills shortage could delay green-collar jobs (http://business.theage.com.au/business/skills-shortage-could-delay-greencollar-jobs-20080918-4iz6.html)

30 CSIRO (2008) - Growing the green collar economy (http://www.csiro.au/files/files/plej.pdf)

3 Current and future skills profiles in environment - related industries

3.1 Introduction

For the productivity and growth of industries not only the number of employees is important, but also the skills profiles of these employees. The knowledge, skills and competences that Europe needs to be competitive on the global labour market have a high priority on the EU policy agenda[31]. More and better skills are essential for economies as they make it easier to innovate, adopt new technologies, attract investment, compete in new markets, and diversify the economy. This, in turn, increases job growth along with productivity[32].

This chapter starts with an overview of the current needs for skills in the environment-related industries in the EU and provides information on skills profiles in the environment-related industries (section 3.2). After undertaking a scan of the available literature on skills in the environment-related sectors it became apparent that there is little information on this topic. There is only information on a small number of environment-related sectors in a few EU Member States. At the end of this section, this Member State-specific information will be provided. The countries covered are the UK, Portugal and Spain. The OECD states that in Italy no analysis has been conducted regarding the skill needs in environment-related sectors (in 2002)[33].

Section 3.3 starts off with a discussion of the future skill profiles in general, before it looks as the future skill profiles in environment-related sectors. In this section, climate change will be emphasized. Again, due to the limited availability of data only information is provided on certain sectors. Also, some of the data is on the whole world and not only on Europe. The report then continues by looking at the education level of new labour supply in the near future. This is important to know as this could give information on whether the supply and demand for skills will be met in the future.

At the end of the section, a small outlook on future skills in Germany's renewable sector is provided, as this was the only information found after a scan of the available literature.

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31 CEDEFOP (2008). Future Skill needs in Europe. Focus on 2020. http://www.trainingvillage.gr/etv/Upload/Information_resources/Bookshop/498/4080_en.pdf

32 CEDEFOP (2008), ILO Green Jobs Initiative and implications for skills development http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-presentation_evans-klock_(2).pdf

33 OECD (2002). Environmental Performance Reviews. Italy http://books.google.nl/books?id=v_Ka7NDlwx8C&pg=PA160&lpg=PA160&dq=italy+skill+eco-industry&source=bl&ots=hkZ-NfO_yb&sig=HJEOAFQ7qX8pSgQu2iefRQJPmLs&hl=nl&sa=X&oi=book_result&resnum=2&ct=result#PPA160,M1

Where possible, a special focus is put on France, Italy, Spain, Germany, the UK and Poland throughout the chapter.

3.2 Current skills profiles

3.2.1 Existence of environmental skills

This subsection discusses the existence of environmental skills. According to the OECD, environmental job qualifications and skills are traditional qualifications and skills applied to environmental issues. This would mean that there are no environmental qualifications per se, but that there are for example chemists working in the water and waste sectors[34]. In a comparative study done by the Austrian Institut für Wirtschaft und Umwelt it is stated that the environmental goods and services industry (EGS industry) does not necessarily has different qualification requirements compared to the general qualification requirements. Proof for this could be that the number of people in specific training programmes for environmental jobs (most often in higher education) was significantly higher than the need. This means that those people can not find jobs even though the field is enlarging[35].

However, according to other experts, specific skills profiles are required in the Green Economy. Examples of these are knowledge of sustainable materials, relevant traditional skills, "Carbon foot printing" skills, environmental impact assessment skills (flora, fauna) and good understanding of the 'sound' sciences.

The generic skills needed for the Green Economy are strategic/leadership skills, adaptability/transferability skills, systems analysis (primacy of design), holistic approach, risk analysis, co-ordination skills, and entrepreneurship. The complexity of these skills increases with the complexity of the jobs[36].

3.2.2 Data on skills profiles in green economy generally insufficient

For the economy in total, it is known that, due to technological progress, the demand for low-skill workers has decreased and the demand and rewards for higher-skill workers have increased[37]. Unfortunately, little is know on the skills base of the green economy for two reasons. First of all, the green economy is not well defined as a sector of activity. Second, environmental skills are not necessarily considered to differ from general traditional labour skills.

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34 OECD Seminar Social and Environment Interface Proceedings (1999). http://www.oecd.org/dataoecd/51/15/33848718.pdf

35 OECD Seminar Social and Environment Interface Proceedings (1999). http://www.oecd.org/dataoecd/51/15/33848718.pdf

36 Cedefop. 6-7 October 2008. Thessaloniki, Greece. Future skill needs for the green economy http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-focus_group_reports.pdf

37 IMF (2008). Global Monitoring Report 2008. Agenda for Inclusive and Sustainable Development. MDGs and the Environment http://www.imf.org/external/pubs/ft/gmr/2008/eng/gmr.pdf

Nevertheless, it is possible to gain information on skills in certain sectors of the eco-industry by drawing together a variety of data[38].

According to the study of Ernst & Young for DG Environment (2006) called 'Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU'[39], little information is available on the skills profiles in nature protection, biodiversity conservation and natural hazards prevention sectors. The majority of information available is on the eco-industry sector[40].

Both the OECD study 'Environment and Employment: an Assessment' and a working document of the EC[41] state that the environmental goods and services industry has a relatively polarised skills profile[42]. However, according to the OECD (1999), more than 70 percent of environment-related jobs are manual and clerical positions[43].

The study 'Green jobs: Towards decent work in a sustainable, low-carbon world' argues that green jobs consist of a wide range of skills and educational backgrounds[44]. ECOTEC states that parts of the environmental sector consist of highly educated and skilled workers. Examples are environmental consultants and researchers[45].

3.2.3 Skill profiles in eco-consulting, eco-industry and waste management, agriculture and fishery and the agri-food sector

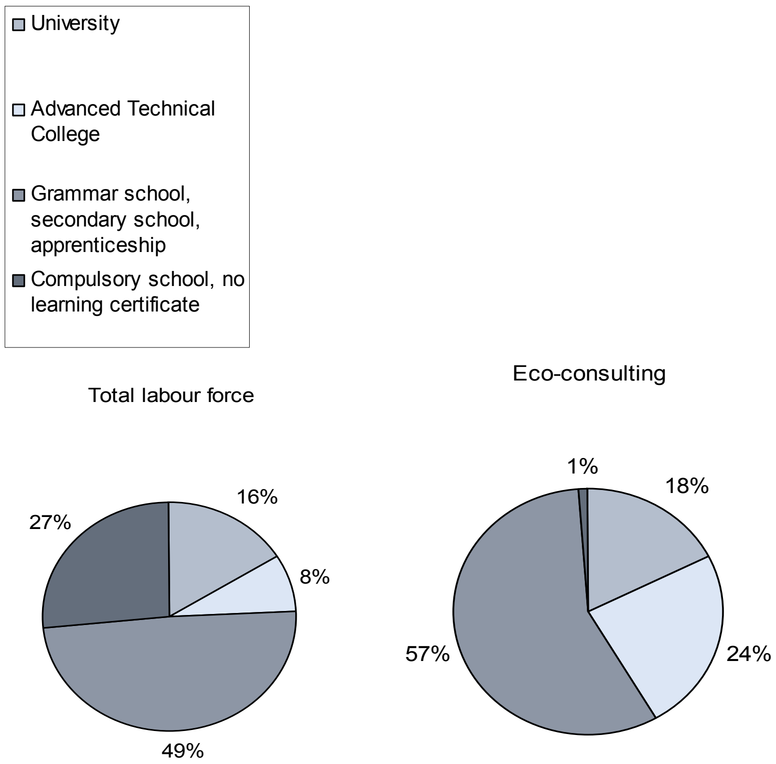
Whilst little information is available on skills profiles in environment-related sectors in general, some information is available for specific sub-sectors such as waste management (for 2000 the educational background of the workers is given), agriculture and fishery (number of skilled workers) and the agri-food sector (education level). Very little information is known on the renewables industry.

Skills in the in eco-consulting, eco-industry and waste management (educational background - 2000)
Figure 3.1 illustrates the environment-related employment by educational background for different sectors in the EU in 2000. For the total labour force, but also for the three sectors outlined in the report (eco-consulting, eco-industry and waste management, the highest share of educational background is the category of 'grammar school, secondary school, a completed apprenticeship' (varying between 48% and 58%). The shares of the other educational backgrounds differ significantly within sectors. For example, while the share of compulsory school or no learning certificate is 42 percent in waste management

38 Hogarth (2008). Emerging Skill Needs In a Greener UK Economy http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-presentation_hogarth_(2).pdf
39 Ernst & Young for European Commission DG Environment (2006). Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU
40 Ernst & Young for European Commission DG Environment (2006). Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU
41 EC (2005). Commission Staff Working Document on the links between employment policies and environment policies. http://ec.europa.eu/environment/integration/pdf/sec_2005_1530_en.pdf
42 OECD (2004). Environment and Employment: An Assessment
43 OECD Seminar Social and Environment Interface Proceedings (1999). http://www.oecd.org/dataoecd/51/15/33848718.pdf
44 UNEP et al. (2008). Green Jobs: Towards decent work in a sustainable low-carbon world http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_098503.pdf
45 ECOTEC (2002). Analysis of the EU Eco-Industries. their Employment and Export Potential

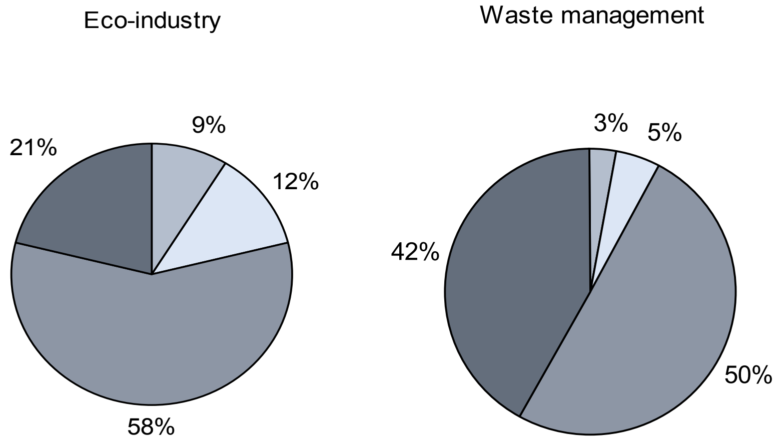
(i.e. waste collection, handling and recycling pick-up tasks), it is only 1 percent in eco-consulting. For most of the jobs in waste management it is not necessary that employees have a completed education and training[46]. The eco-consultant sector has the highest share of people with a university degree and the waste management sector the lowest. Jobs in environmental consulting are thus mainly undertaken by highly-skilled people, while jobs in waste collection and sorting are mainly undertaken by relatively low skilled people. In eco-consulting more technicians and crafts people are employed than in other sectors, however, the sector as a whole also has more helpers and labourers than average[47].

Figure 3.1 Environment-related employment by educational background and sectors in % (total EU, 2000)



[46] OECD (2004). Environment and Employment: An Assessment

[47] EC (2005). Commission Staff Working Document on the links between employment policies and environment policies. http://ec.europa.eu/environment/integration/pdf/sec_2005_1530_en.pdf



Source: OECD (2004). Environment and Employment: An Assessment
As the percentages did not add up to 100% for the total labour force and for eco-consulting the figures are levelled up to 100%.

Table 3.1 shows the environment-related employment in 2000 by educational background per sector and per country. For most of the countries it holds that the highest share of educational background in all of the environment-related sectors is 'grammar school, secondary school, a completed apprenticeship'. Two countries are slightly different; Austria (highest share of educational background in waste management is ‘compulsory school, no learning certificate’) and Germany (highest share of educational background in eco-consulting is ‘university’). Spain has a significantly different profile: the highest share of educational background in eco-consulting and eco-industry is ‘university’. In waste management this is ‘compulsory school, no learning certificate’. It is also striking that the highest share in the total labour force is ‘compulsory school, no learning certificate’ (58%).

Table 3.1 Environment-related employment by educational background and sectors (2000)

Levels of education	University	Advanced technical College	Grammar school, secondary school, apprenticeship	Compulsory school, no learning certificate
Countries and sectors	Shares in per cent			
Austria				
Total labour force	7	2	69	22
Eco-consulting	25	15	60	0
Eco-industry	3	4	69	24
Waste management	1	0	42	57
Germany				
Total labour force	15	9	59	14
Eco-consulting	54	22	21	2
Eco-industry	6	9	57	28
Waste management	5	6	61	28
Netherlands				
Total labour force	26		43	31
Eco-consulting	13	26	54	2
Eco-industry	11	21	52	15
Waste management	2	7	55	35
Spain				
Total labour force	17	8	17	58
Eco-consulting	41	20	40	0
Eco-industry	33	29	27	11
Waste management	3	3	28	66
Sweden				
Total labour force	13	16	50	21
Eco-consulting	15	23	62	0
Eco-industry	13	16	59	13
Waste management	4	4	47	45

Source: OECD (2004). Environment and Employment: An Assessment

Skills in agriculture and fishery (number of skilled workers)

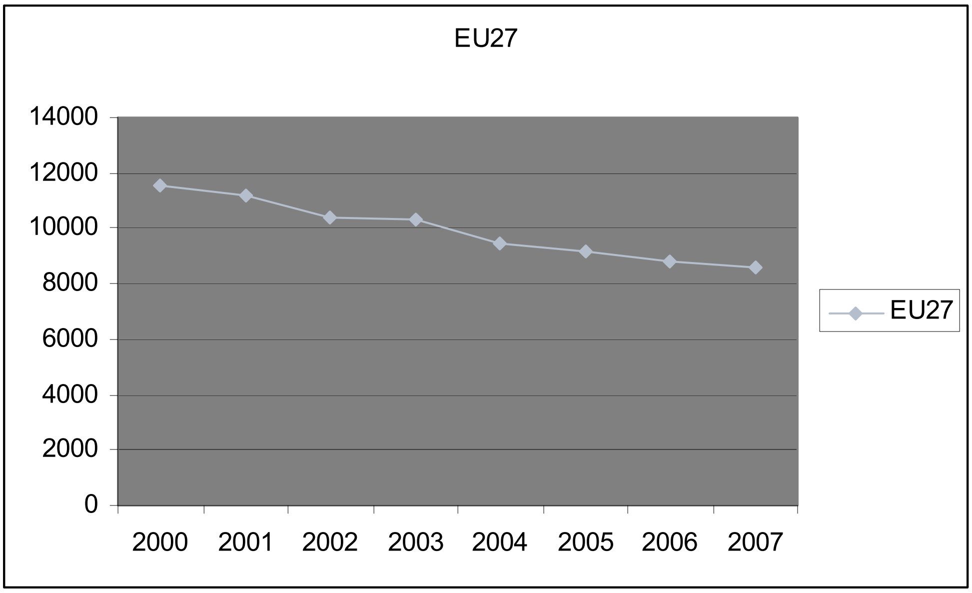
Looking at the agricultural sector, only 17 percent of farmers in the EU-15 finished a basic or full training in agriculture. This statistic ranges from 3 percent in Greece to 64 percent in the Netherlands[48].

The number of skilled agriculture and fishery workers by Member State is the only direct statistic EUROSTAT provides on skills in environment-related sectors. In figure 3.2 the numbers are shown for the EU-27. As can be seen from the figure, the number of skilled agriculture and fishery workers in the EU-27 has been decreasing since 2000 and was 8,580,100 in 2007. The employment in medium-skill intensive occupations (to which agricultural and fishery workers belong) also declined between 2000 and 2005[49].

48 Hortet. E. (2006). The rural development policy 2007-2013: future skills needs in the agri- food sector http://www.trainingvillage.gr/etv/upload/etvnews/news/2144-att1-1-03_ester_hortet.pdf.

49 Cedefop (2008). AGRIFOOD. http://www.trainingvillage.gr/etv/Upload/Projects_Networks/Skillsnet/Sectors/AGRIFOOD.pdf

Figure 3.2 Skilled agriculture and fishery workers in EU-27 (between 15 and 64 years – in thousands)



Source: EUROSTAT

Regarding this statistic, both the actual numbers and the trend differ between Member States. This can be seen in the table below. In figure 3.3 the trends for Germany, France, Italy, Spain, Poland and the UK are given.

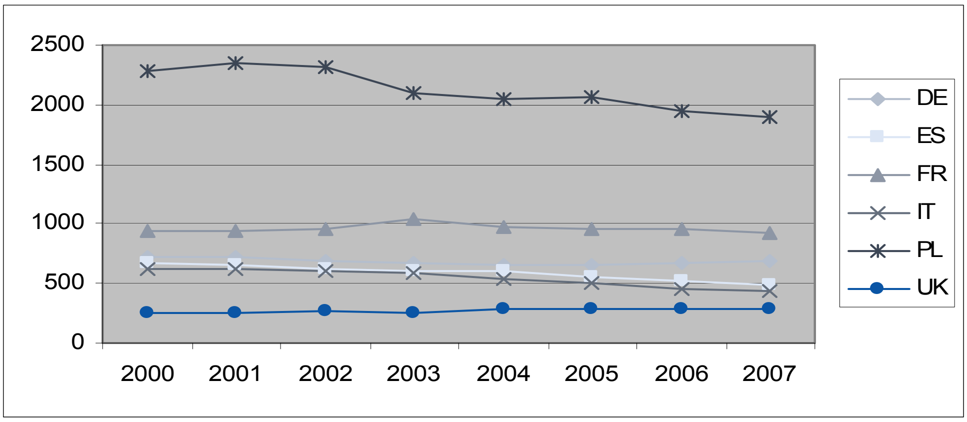
Table 3.2 Skilled agriculture and fishery workers in Member States (between 15 and 64 years)

	2000	2001	2002	2003	2004	2005	2006	2007
EU27	11521.9	11186.8	10425.9	10332.1	9462.6	9186.1	8833.2	8580.1
BE	77.6	52.8	74.3	67.5	94.1	87.2	83.4	78.3
BG	228.7	147.5	171.9	180.6	191.8	152	151.7	143.8
CZ	96.5	91.7	90.6	89.8	80.4	73.9	71.9	71.8
DK	65.5	55.2	54	64	67.6	60.3	58.3	57.8
DE	722.2	729.1	692	674.5	650.8	656.5	665.5	681.9
EE	18.9	16.1	16.6	12.3	11.5	13.4	11.2	11.7
IE	14.9	15.6	14.6	13	12.3	13.6	15.1	14.8
GR	641.9	597.1	586.5	589.4	485.3	486	472.3	459.9
ES	676.1	648.9	616.3	605.5	596.8	551	518.4	488.3
FR	946.9	947.8	950.1	1048.6	974.3	950.1	959.5	914.6
IT	624	619.2	601.2	587.6	530.5	498.7	460.6	429.9
CY	8.4	7.8	8.4	8.1	8.4	7.7	7.2	7.9
LV	76.8	74.8	65.5	84.4	76.3	56.6	62.1	50.5
LT	196.2	200.6	217.2	212.2	184.9	163.1	132	105.5
LU	5.1	3.4	4.5	4.1	3.4	3.7	4.2	4.3
HU	131.7	135.1	132.3	122.3	118.4	106.7	109.1	101.3
MT	2.3	2.3	2.6	2.7	2.7	2	2.6	2.3
NL	142.8	130.6	113.3	121.9	119.7	119.5	118.4	116
AT	184.5	176.8	185.9	178.8	167.1	185.8	189.9	185.6
PL	2278.5	2344.4	2316.2	2098	2049.6	2067.2	1950.1	1893.2
PT	358.3	376	356.5	365.1	344.9	333.9	327.3	320.2

	2000	2001	2002	2003	2004	2005	2006	2007
RO	3472.5	3261.6	2585.3	2648.8	2114.3	2046.4	1916.7	1906.8
SI	58.1	60.9	60.7	50.9	63.6	54.1	53.5	51.6
SK	28.6	23.1	26.8	29.1	27	25.3	25.7	22.9
FI	129.1	123.6	122.5	116.9	108.8	103.3	98.9	97.6
SE	88.8	94.9	90.1	96.6	92.4	84.6	85.1	80.6
UK	246.9	250	269.8	259.4	285.7	283.4	282.1	280.8
HR	:	:	161.2	175.5	178.1	182.1	144.3	145.6
TR	:	:	:	:	:	:	4387.5	4244
IS	10.2	8.6	8.6	7.8	6	7	7.6	6.7
NO	81.3	77.2	75.4	72.2	67.3	61.2	59	55.6
CH	157.7	160.2	158.7	149.2	142.2	144.9	145.8	150.6

Source: Eurostat.

Figure 3.3 Skilled agriculture and fishery workers in Member States (between 15 and 64 years)



Source: Eurostat.

Skills in the agri-food sector (education level)

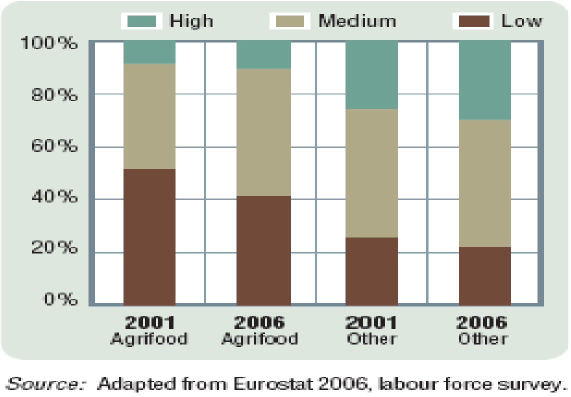
Figure 3.4 illustrates the level of education in the agri-food sector (agriculture, fishery, food and beverage) as well as in all other economic sectors in 2001 and 2006 in the EU-27 (in %)[50]. As the figure shows, the level of education in the agri-food sector increased substantially between 2000 and 2006. Although the share of highly educated people in the agri-food sector in 2006 is lower than in other economic sectors, this share increased compared to 2001. However, the increase of the level of education in the agri-food sector is mainly due to the increase in the share of medium educated people.

The demand for new skills and a different type of the workforce in the agri-food sector is caused by the diversification of primary production (the attempt to generate more income from other sources) as well as by the enlargement of farms. Skills that are seen as very important are: entrepreneurial skills, employability, coping with waste management,

[50] Cedefop (2008). AGRIFOOD. http://www.trainingvillage.gr/etv/Upload/Projects_Networks/Skillsnet/Sectors/AGRIFOOD.pdf

innovative skills on an interdisciplinary level and skills needed for human resources management[51].

Figure 3.4 Education level in agri-food sector and in all other economic sectors (NACE), 2001 and 2006 (%), EU-27



Source: Cedefop (2008)

Skills in renewables

The renewable energy sector is very important for the European economy. The main renewable energy sectors in the EU are wind, photovoltaic, geothermal, biomass, hydropower and solar thermal energy. In these sectors, significant improvements are made in terms of efficiency, reliability and economics. Also, political action is becoming more established (e.g. in regulation, financial incentives and national target setting). However, there are barriers to the successful development of renewable energy and achieving EU and worldwide environment targets. One of the main barriers is the availability of trained people.

The expected net employment growth in the renewable energy sector equals 1,660,000 by 2010 and 2,463,000 by 2020. However, despite of the current and expected employment growth there are shortages in trained and competent employees. This condition will probably worsen as the sector is trying to grow to meet energy targets and demand.

The renewables and efficiency-related parts of the economy comprise of workers of all educational and skill levels. Some occupations in these sectors employ highly educated and specialized personnel such as technicians, engineers, and skilled trades. Jobs in biofuels processing require more technical skills. The jobs in recycling are very diverse in terms of required skills, health and occupational conditions, and wage[52].

UNEP states that the majority of technologies used in the renewable energy sector do not necessarily require highly skilled workers to operate them[53]. Higher skills are required in bio fuels processing than in feedstock production and harvesting.[54]

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51 Cedefop (2008). AGRIFOOD. http://www.trainingvillage.gr/etv/Upload/Projects_Networks/Skillsnet/Sectors/AGRIFOOD.pdf

52 UNEP et al. (2008). Green Jobs: Towards decent work in a sustainable low-carbon world http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_098503.pdf

53 UNEP (2007). Labour and the Environment: A Natural Synergy.

54 Website of Worldwatch Institute. Renner. M. (2008): http://www.worldwatch.org/node/5821.

According to the handbook for Career Advisors and Occupational Councillors, many of the professions in the renewable energy sector originate from the more traditional science and engineering or business and management fields. This means that, to a large extent, professions in the renewable energy sector are transferable to and from other sectors and that this can be done with relatively limited retraining. Nevertheless, it is worth noting that new professions have also emerged.

Below details regarding the labour skills employed in the sectors wind energy, photovoltaic energy, geothermal energy and biomass will be given.

Wind energy
According to the Danish Wind Industry Association, only 50 percent of the manufacturing is skilled or 'salaried' workers. The rest of the manufacturing workforce comprises of production line workers[55].

Photovoltaic energy
The growth in jobs in this sector was approximately 15,000. This was mainly due to the significant European PV market growth in 2002 and 2003. Many of these are considered to be skilled or 'high-tech' jobs.

Geothermal energy
This sector requires an increased supply of experts in the soil mechanics and aquifer modelling areas.

Biomass
A new nuclear plant creates little employment and the employment it does create is generally for highly skilled staff. An energy plant based on the use of biomass, on the other hand, not only creates more employment but also creates jobs which are in general open to lower skilled staff[56].

Skills in the cement sector
Very little information was available on this topic. The only sound conclusion which can be drawn is that the level of qualifications (general skills, not green skills) of the jobs in the European cement sector has increased over the past several years[57].

3.2.4 Skills in environment-related industries in EU Member States

As was mentioned before, after a scan of the existing literature it became apparent that there is only information on a small number of environment-related sectors in a few EU Member States. For several sectors, information on the UK, Portugal and Spain is available. Information is provided by sector/profession in this subsection. In contrast,

55 Website Danish Wind Industry Association http://www.windpower.org/
56 EARTHCARE (2006). Employment in the Renewable Energy Sector - Overview & Example Job-Profiles - Handbook for Career Advisors and Occupational Councilors. July 2006
57 ETUC (2007). Climate Change and employment. Impact on employment in the European Union-25 of climate change and CO2 emission reduction measures by 2030 http://www.tradeunionpress.eu/Web/EN/Activities/Environment/Studyclimatechange/rapport.

quite a large amount of information is on hand on the skill profiles in environment-related industries in Portugal (in 1997). As a consequence, Portugal will be discussed separately from the UK and Spain.

Environmental Technology and Service (UK)

The specific need for skills in the British ETS (Environmental Technology and Services) sector varies by sub sector. Low skill segments (e.g. routine collection and disposal of non-hazardous waste), medium segments and high skill segments can be identified. In the ETS sector there is little reporting of technical skills shortages[58] and there is ambivalent information about the supply of scientific and engineering skills[59]. A conclusion which can be drawn from available data is that a large number of graduates and post-graduates are employed in this sector. In the South West of the UK, 80 percent of the firms in this sector employed graduates and 50 percent employed post-graduates (2002). However, 75 percent of these firms are firms that employ 20 employees or less[60].

Environmental and sustainable development specialists (UK)

The report 'Mind the Skills Gap' looks at the skills needed for sustainable communities in the UK[61]. A focuses is taken on the environmental sector, which includes environmental and sustainable development specialists. The report states that there are labour shortages of environmental specialists, which are expected to worsen temporarily but later improve again. By 2012 a surplus of 8 percent is expected. The shortage of sustainable development experts is expected to gradually increase and will be higher than 70 percent by 2012.

Individuals in the environmental sector are concerned about the depth and span of their technical skills. Identified gaps are in project management, stakeholder management, leadership, conflict resolution, inclusive visioning and breakthrough thinking. Sustainable development experts believe that there is a gap in resolution and project management. Furthermore, the report finds that the need for generic skills is increasing in this sector. More than 20 percent of the respondents answered that their organisation needed more environmental specialists and sustainable development experts with generic skills[62].

Renewables (Spain)

The share of highly educated people in the Spanish renewable energy sector is the highest for enterprises with less than 10 employees and enterprises with between 251 and 1,000 employees (respectively 38.0% and 33.4%). This can be seen from table 3.3. Firms with more than 1,000 workers have the highest share of workers.

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58 'Skill shortage is a genuine lack of adequately skilled individuals available in the accessible labour market with the type of skill being sought and which leads to a difficulty in recruitment (NSTF 1998)' Source: http://www.trainingvillage.gr/etv/Upload/Projects_Networks/Skillsnet/Publications/Striestka-skills_shortages.pdf

59 Hogarth (2008). Emerging Skill Needs In a Greener UK Economy http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-presentation_hogarth_(2).pdf

60 The sector skill council for electricity, gas, waste management and water (2006). Sector skills mapping in the Environment Technology Sector

61 ASC (2007). Mind the Skills Gap. The skills we need for sustainable communities

62 ASC (2007). Mind the Skills Gap. The skills we need for sustainable communities

Table 3.3 Distribution of personnel by qualification (%)

Qualification	Company size by number of workers					
	< 10	11-50	51-250	251-1.000	>1.000	TOTAL
University graduates	38,0	19,7	24,9	33,4	26,9	32,3
Technical graduates	21,2	17,1	15,4	17,0	11,4	18,4
Management	9,4	8,3	7,7	7,9	4,4	8,6
Supervisors	21,7	30,7	38,2	31,7	18,0	28,0
Workers	9,7	14,3	13,8	10,0	39,3	12,7

Source: ISTAS

Source: ISTAS (2008). Future skills needed in renewable energies in Spain: "A vision of enterprises"

However, as the table below demonstrates, it is also harder to fill the higher-level jobs than it is to fill workers' jobs. This is mainly due to the lack of sufficient technical experience. The demand for the various occupations does not differ greatly between sub-sectors (wind, solar, solar thermal). Industrial engineers are demanded by promoters and for management positions in plant construction, installation and manufacturing[63].

Table 3.4 Difficulties in filling jobs

Type of job	% companies
University graduates	16.1
Technical graduates	11.4
Management	4.3
Supervisors	27.7
Workers	6.9
NA – No difficulties	53.8

Source: ISTAS (2008). Future skills needed in renewable energies in Spain: "A vision of enterprises"

Ecologists, nuclear energy industry and waste management industry (UK)

As very little information can be found on the skills profiles of ecologists, nuclear energy industry employees and waste management industry employees, the information is provided under the same heading.

In the British waste management industry, skill levels were increasing at the end of the nineties due to the shift towards more value-added services (such as the provision of waste audit advice to private sector companies)[64].

According to the IEEM (Institute of Ecology and Environmental Management), there is a skills and competence gap for ecologists in the UK. This is due to a lack of specific skills, a poor science base and a lack of critical general skills[65]. The nuclear energy sector mainly faces skill shortages related to generic skills[66].

63 ISTAS (2008). Future skills needed in renewable energies in Spain: "A vision of enterprises" http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-future_skills_from_enterprises_(english_final_version).pdf

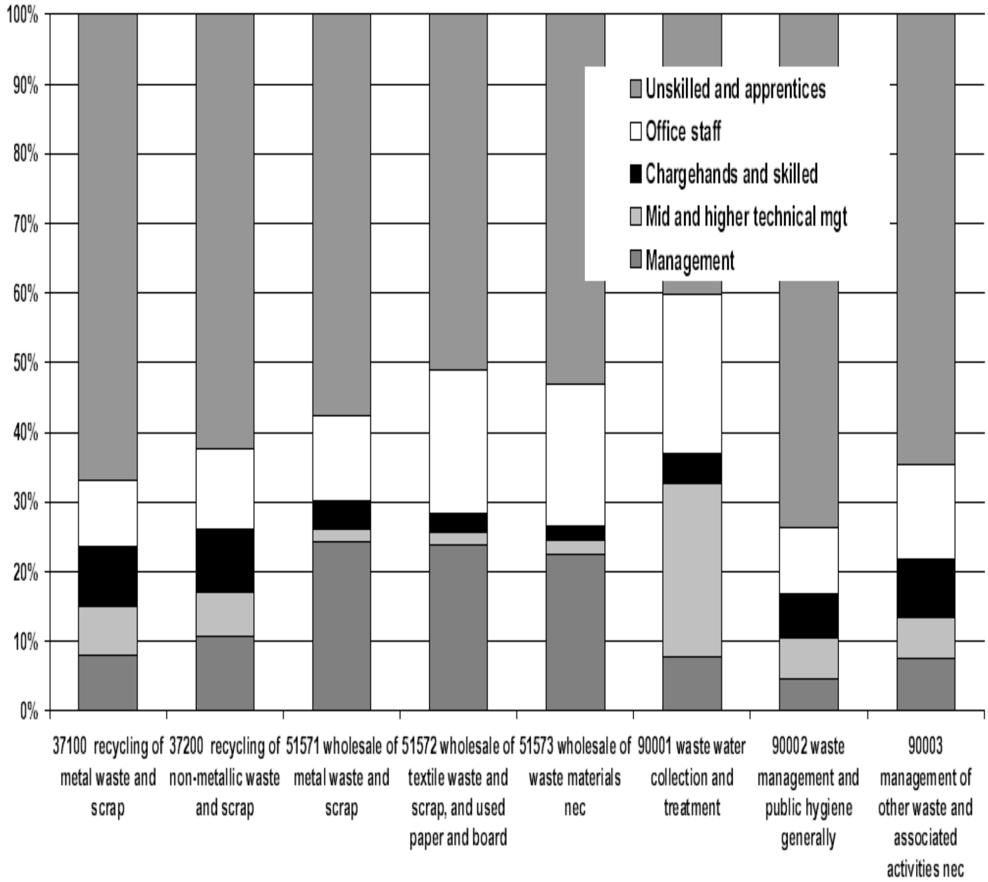
64 Annex 8, MEMBER STATE EMPLOYMENT SUMMARIES, http://ec.europa.eu/environment/enveco/industry_employment/pdf/annex8.pdf

65 Wade, M. A model for the education and training of ecologists and environmental managers in the UK: filling the skills gap http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-presentation_wade.pdf

66 Hogarth (2008). Emerging Skill Needs In a Greener UK Economy

Environment-related sectors in Portugal
The skills profile of employees in environment related industries in Portugal (1997) is shown in the figure 3.8. As can be seen, all industry sectors employ a very high proportion of unskilled labour. However, there are big differences between the shares of professions within the sectors. For example, the share of managers is highest in the wholesale of metal waste and scrap sector and much lower in waste management and public hygiene sector. The share of mid and higher technical management is the highest in the sector waste water collection and treatment.

Figure 3.5 Core activities employees distribution, according to functional groups and broken down by CAE Rev. 2 sub-classes (1997)



Source: Eurostat Working Papers (2000), Environment Industry and Employment in Portugal, 1997

3.3 Future skills profiles

3.3.1 High priority on EU agenda: anticipating changing skill needs (general)

The EU's ambition to achieve sustainable growth requires Member states to not only have the necessary skills now, but also in the future.

http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-presentation_hogarth_(2).pdf

The need for Europe to put more effort into anticipating changing skill needs is emphasized by the re-launched Lisbon strategy as well as by other policy documents. Anticipating changing skill needs is considered a priority for the coming ten years[67].

Acknowledging the challenge of gaining the necessary knowledge, skills and competences to be able to compete successfully in a global labour market, the 2007 Council Resolution 'New skills for new jobs' stressed the need for the EU to anticipate the skill needs and skill gaps the European labour market is going to face in the future[68]. Also, emphasis was put on the need to increase overall skill levels and the need for a better matching of knowledge, skills and competences to social and economic needs[69].

A comprehensive assessment of skill requirements in Europe up to 2020 was requested by the 2008 Spring European Council and taken up in the June 2008 Council conclusions 'Anticipating and matching labour market needs, with special emphasis on youth - a jobs and skills initiative'[70].

3.3.2 Future of skills –general: potential skills shortages and increasing demand for higher educated people

The demand and supply for skills will mainly be affected by globalisation, technological change and demographical change (including ageing and migration). Skillsnet identifies the following changes in skills due to those transformations[71]:

- Rise of new skill requirements;
- Requirement of higher skill-level;
- Change of skill and competence composition of occupations;
- Multitasking / multiskilling;
- Rise of new and hybrid occupations;
- Generic/ core/ social skill requirements;
- Skill shortages;
- Skill gaps[72].

The IER et al. state that the future of skills is as follows:

- The speed of change in technology, globalisation and their impacts on changing patterns of employment by sector and skills are accelerating;
- Numerous existing skills will become obsolete. For this reason upskilling and retraining the current workforce is very important;

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67 CEDEFOP (2008). Future Skill needs in Europe. Focus on 2020. http://www.trainingvillage.gr/etv/Upload/Information_resources/Bookshop/498/4080_en.pdf

68 'Skills gaps are used to describe the qualitative mismatch between the supply or availability of human recourses and the requirements of the labour market'. Source: http://www.trainingvillage.gr/etv/Upload/Projects_Networks/Skillsnet/Publications/Striestka-skills_shortages.pdf

69 CEDEFOP (2008). Future Skill needs in Europe. Focus on 2020. http://www.trainingvillage.gr/etv/Upload/Information_resources/Bookshop/498/4080_en.pdf

70 CEDEFOP (2008). Future Skill needs in Europe. Focus on 2020. http://www.trainingvillage.gr/etv/Upload/Information_resources/Bookshop/498/4080_en.pdf

71 The early identification of skill needs network of Cedefop.

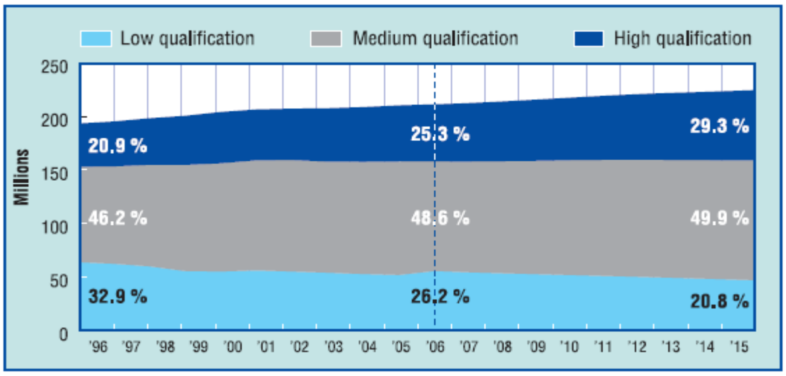
72 Strietska-Illina (2008). Skills net. Enterprise surveys as a tool for skill needs analysis. http://agora.Cedefop.europa.eu/skillsnet2008innet/UsersFiles/sa/documents/Presentetion2/12_Strietska.ppt#273.3.Such changes cause.

- The demand for higher level skills will continue to increase due to structural, occupational, technological and demographic change;
- The need for good technical and employability skills remains the main reason of many skill shortages;
- Due to the need to replace skill profiles the demand for low-skilled and semiskilled jobs in sectors like manufacturing and construction will continue to increase[73].

From these developments it appears that potential skills shortages and increasing demand for medium and higher educated people will arise. However, a growth in demand for several lower-skilled categories can also be expected[74].

Between 2006 and 2015, the number of jobs with the highest qualification level will increase by more than 12.5 million jobs in Europe. Jobs at medium level (including vocational qualifications) will increase by almost 9.5 million and jobs with the lowest qualifications will decrease by 8.5 million. In 2015, the share of jobs that require high, medium and low qualifications will respectively be 30, 50 and 20 percent. This is shown in figure 3.9. However, it should be noted that this differs per country, per sector and per occupation[75].

Figure 3.6 Qualification requirements by level of qualification (in million, %), 1996-2015, EU-25, Norway and Switzerland.



Source: Cedefop, 2008.

Consequence of potential skill gaps: workforce shortages in 2020

The European employment rate will need to be almost 74 percent to satisfy the future labour market demand. The Lisbon Strategy targets an employment rate of 70 percent. This would mean that if this target is met by 2020 there will still be a shortage of almost

[73] Wilson. R.A (2007). European Skills for the 21st Century http://www.trainingvillage.gr/etv/Upload/Projects_Networks/Skillsnet/Publications/Wilson-European_skills_for_the_21st_century.pdf

[74] Cedefop (2008). Future Skill needs in Europe. Medium-term forecast.

http://www.skillsweb.eu/Portals/0/Future%20sjkills%20needs.pdf

[75] Cedefop (2008). Future Skill needs in Europe. Medium-term forecast.

http://www.skillsweb.eu/Portals/0/Future%20sjkills%20needs.pdf

12 million people in the workforce. The reason for this shortage is varying occupational structures and potential skill gaps[76].

3.3.3 Environment - related sectors and skill changes: towards more highly skilled people

Regardless of the fact that the environment-related sector is not a well defined sector of activity and that environmental skills are not necessarily distinct, a large number of sources seem to agree that the increase in demand for higher educated people also holds true for environment-related industries.

UNEP states that a transition to a green economy will create demand for workers and that there is clear proof that a high share of the future green jobs will be high skilled (and thus well paid). Adequate training programmes will be needed to fill these new positions[77].

A number of sources suggest there will be a shift towards integrated technology and away from end-of-pipe through natural market changes but also policies such as the Sustainable Production and Consumption policy and the Environmental Technology Action Plan. As a consequence, high-skill jobs are promoted at the expense of low-quality jobs[78]. This is also argued by the AK Wien study, a survey on the impacts of introducing cleaner technologies (in Germany, the Netherlands, Austria, Sweden and Spain), by stating that step-wise upgrades of existing processes and machinery regularly go together with in-firm training and an increase in the skills of employees and job quality[79]. This study concludes that "overall, integrated environmental protection results in clear positive effects regarding employment quality. Apart from a significant increase in skills levels, there is an improvement in physical working conditions."[80] The study does emphasize the importance of continuous training (e.g. for people who worked in low-tech waste management job to have the necessary skills for higher-tech jobs).

A German study focusing on energy-intensive industries also confirms the shift towards jobs corresponding to the highest and medium levels of education. It should be noted, however, that this study argues that climate policies will not have a significant effect for jobs requiring lower qualifications[81].

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76 CEDEFOP (2008). Future Skill needs in Europe. Focus on 2020. http://www.trainingvillage.gr/etv/Upload/Information_resources/Bookshop/498/4080_en.pdf

77 UNEP et al. (2008). Green Jobs: Towards decent work in a sustainable low-carbon world http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_098503.pdf

78 EC (2005). Commission Staff Working Document on the links between employment policies and environment policies. http://ec.europa.eu/environment/integration/pdf/sec_2005_1530_en.pdf

79 EC (2005). Commission Staff Working Document on the links between employment policies and environment policies. http://ec.europa.eu/environment/integration/pdf/sec_2005_1530_en.pdf

80 Institut für Wirtschaft und Umwelt & AK Wien (2000). Environment and employment: sustainability strategies and their impact on employment

81 ETUC (2007). Climate Change and employment. Impact on employment in the European Union-25 of climate change and CO2 emission reduction measures by 2030 http://www.tradeunionpress.eu/Web/EN/Activities/Environment/Studyclimatechange/rapport.

3.3.4 Skill shortages in the EU: potential threat for the green expansion

Several sectors already face skill shortages[82] and there are signs that these skill shortages could hamper the greening of the economy[83]. The Directive on Energy Efficiency of Buildings promotes combining environmental and training measures. However, according to several national trade unions, a shortage of skilled people exists and as a consequence there will not be enough qualified workers to implement the Directive[84].

The following information was available on skill shortages in the EU:
- British CBI states that sectors going "green" are experiencing a skills gap due to the shortage of supply of technical specialists, designers, engineers, and electricians.
- Germany's renewables industry is suffering from a shortage of qualified workers.
- There are even skills gap in sales staff in the retail sector and in project managers specialising in delivering a range of mitigation and adaptation solutions.
- Often, more skills are needed for the renewable energy sector (i.e. consulting skills, communication skills).

In many OECD countries, firms in the growing green economy struggle to find workers with the required skills. Reasons for this include deindustrialization and the off-shoring of manufacturing firms[85].

3.3.5 Future skill trends in several environment-related sectors

Also on possible future skill trends in environment-related sectors little information is available. Table 3.5 describes the future skill trends in several sectors. Please note that most information deals with the whole world and not only with Europe.

Table 3.5 Future skills in environment-related sectors

Carbon capture and storage (CCS)	• Technically more complex operations will involve workers with a very different skill set
Buildings	• Higher-skilled, higher-paying employment will arise due to energy-efficient equipment. • Jobs are likely to be performed by workers who already work in the building sector. However, these jobs will be redefined in terms of new skills, training, and certification requirements. • Potential will arise for highly skilled researchers and engineers. Extensive training needs in four main areas: diagnostic techniques, knowledge of renewable energy, installation, organizational skills (i.e. town planning).

82 Cedefop (2008). Future Skill needs in Europe. Focus on 2020. http://www.trainingvillage.gr/etv/Upload/Information_resources/Bookshop/498/4080_en.pdf

83 UNEP et al. (2008). Green Jobs: Towards decent work in a sustainable low-carbon world http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_098503.pdf

84 ETUC (2006). Mid-term review of the 6th Community Environment Action Programme. Position of the European trade union confederation (ETUC) http://www.etuc.org/IMG/pdf/6th_EAP_mid-term_Review11.pdf

85 UNEP et al. (2008). Green Jobs: Towards decent work in a sustainable low-carbon world http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_098503.pdf

Cement	• Jobs in this industry are expected to require higher levels of skills.
Wind Power Industry (renewables)	• Many of the positions will require highly skilled people. • Universities need to consider offering entirely new study fields and majors due to technology development.
Climate change	• Climate information and forecasting as well as R&D into crops adapted to new weather patterns have the potential to create specialized and high-skill employment.
Agriculture	• Jobs for agricultural skilled workers, for clerks and for craft and related trades workers will decrease. • The requirement for skilled agricultural and fishery workers will be about 2.2 million in 2015
Electricity	• It is probable that together with technical competences management skills will be required
Rail sector	• It appears that a dangerous shortage of skilled workers is emerging. This shortage of skilled workforce might take place by 2030
Waste treatment and recovery/recycling	• The quick technological changes in these sectors are creating an increasing demand for new skills.

Source: UNEP et al (2008). Green Jobs: Towards decent work in a sustainable low-carbon world, ETUC (2007). Climate Change and employment. Impact on employment in the European Union-25 of climate change and CO2 emission reduction measures by 2030, ECOTEC (2002). Analysis of the EU Eco-Industries: their Employment and Export Potential, Dupressoir (2008), ETUC, Impact of climate change mitigation policies on employment in the EU, Cedefop (2008). Future Skill needs in Europe. Focus on 2020.

Climate change and skills

As relatively more information is available on climate change and skills, this topic is discussed in more detail.

Policies at the community, national and international level to mitigate and adapt to climate change will directly affect the level and structure of employment and skill needs worldwide[86]. Unfortunately, there is little information on the exact magnitude of the changes that are likely to occur. Nevertheless, it is clear that skills development will be important if mitigation and adaptation policies are to be effective and efficient[87]. According to the UK government, building a low carbon economy is only possible by unlocking the skills, creativity, entrepreneurialism and capacity to innovate firms, the workforce and communities[88].

According to stakeholders[89] in the sectors believed to be most influenced by climate change (agriculture/forestry/fisheries, tourism, and finance/insurance), climate policies should contribute to an increase in the demand for better educated and skilled workers and a decrease in the demand for lower skilled workers[90].

86 World Resources Institute et al. (2005). from http://www.ilo.org/public/english/employment/skills/download/ilcreport.pdf

87 International Labour Conference, 97th Session, 2008, Skills for improved productivity, employment growth and development.

88 HM Government (2007). Building a low Carbon economy, Unlocking Innovation and Skills.

89 For the study 'Climate Change and employment' interviews were held with key stakeholders at European level, mainly in the sectors believed to be the most influenced by climate change (agriculture/forestry/fisheries, tourism, and finance/insurance).

90 ETUC (2007). Climate Change and employment. Impact on employment in the European Union-25 of climate change and CO2 emission reduction measures by 2030 http://www.tradeunionpress.eu/Web/EN/Activities/Environment/Studyclimatechange/rapport.

3.3.6 Education level of new labour supply in environment-related sectors in the near future

EUROSTAT provides statistics on the number of graduates in four environment related industries, namely the 'agriculture and veterinary' industry, the 'agriculture, forestry and fishery' industry, the 'veterinary' industry and the 'environmental protection' industry. As the number of graduates in a certain field does not automatically mean that this is reflected in the labour market, it cannot be used as an indication for the skills of the labour force in the near future. Still, these statistics do provide information on the education level of new labour supply. This can help indicate whether the supply and demand of skills will be in balance in the future.

Table 3.3 and 3.4 show respectively the number of graduates in upper secondary education and the number of graduates in tertiary education. As is shown in the tables, in the EU there are more graduates on the upper secondary education level than on the tertiary level in the fields of 'agriculture and veterinary' and 'agriculture, forestry and fishery'. For these types of professions the education level of the graduates seems appropriate. The opposite holds for veterinary and environmental protection.

For the UK and Italy there is no information on the number of graduates with upper secondary education, so it is not possible to determine whether the same holds true for these two countries. However, it does hold true for Germany, France and Poland. In Spain there are more graduates on tertiary level than on upper secondary level in the field of agriculture and veterinary. There are no graduates in secondary level in the field of veterinary.

Table 3.6 Graduates upper secondary education - level 3 - pre-vocational and vocational programmes (2006)

	Agriculture and veterinary	Agriculture, forestry and fishery	Veterinary	Environmental protection
EU27	104762	102861	1900	9158
BE	1203	1163	40	64
BE_FR	498	498	0	64
BE_VL	705	665	40	0
BG	2300	2125	175	79
CZ	3730	3484	246	454
DK	1159	1100	59	0
DE	**13555***	**12600**	**954**	**941**
EE	195	195	0	0
IE	:	:	:	:
GR	:	:	:	:
ES	**4577**	**4577**	**0**	**185**
FR	**24191**	**24160**	**31**	**5056**
IT	**:**	**:**	**:**	**:**
CY	0	0	0	0
LV	145	123	22	32
LT	109	109	-	-
LU	83	83	0	0

	Agriculture and veterinary	Agriculture, forestry and fishery	Veterinary	Environmental protection
HU	1084	1084	0	39
MT	11	11	0	0
NL	4991	4991	0	203
AT	:	:	:	:
PL	**8375**	**8223**	**152**	**1698**
PT	:	:	:	:
RO	29275	29275	-	-
SI	896	799	97	0
SK	2276	2152	124	279
FI	2893	2893	0	0
SE	3119	3119	0	26
UK	**:**	**:**	**:**	**:**
HR	:	:	:	:
MK	1087	771	316	0
TR	239	239	0	0
IS	72	72	0	0
LI	0	0	0	0
NO	696	696	0	0
CH	2443	2306	137	13
AL	98	60	38	0

Source: Eurostat

Note: the numbers for France, Italy, Spain, Germany, the UK and Poland are in bold as a special focus is put on these countries

Table 3.7 Graduates tertiary education - levels 5-6 (2006)

	Agriculture and veterinary	Agriculture, forestry and fishery	Veterinary	Environmental protection
EU27	64948	53132	10659	26055
BE	1881	1234	647	173
BE_FR	:	:	:	:
BE_VL	:	:	:	:
BG	928	761	167	541
CZ	2506	2304	202	995
DK	992	820	172	17
DE	**7648***	**6165**	**1483**	**1379**
EE	250	230	20	263
IE	326	:	:	:
GR	:	:	:	:
ES	**5211**	**4068**	**1143**	**2887**
FR	**9753**	**9004**	**749**	**6765**
IT	**4804**	**3611**	**1193**	**1588**
CY	7	7	0	0
LV	266	227	39	298
LT	767	671	96	542
LU	:	:	:	:

	Agriculture and veterinary	Agriculture, forestry and fishery	Veterinary	Environmental protection
HU	1829	1697	132	1122
MT	26	26	0	0
NL	1800	1235	315	636
AT	720	468	252	38
PL	**8312**	**6950**	**781**	**5362**
PT	1303	1046	257	1367
RO	4756	3655	1101	:
SI	412	355	57	174
SK	1156	1069	87	411
FI	912	840	72	183
SE	625	492	133	174
UK	**5577**	**4494**	**1083**	**702**
HR	753	612	141	42
MK	262	234	28	35
TR	14895	10351	4544	1348
IS	25	25	0	5
LI	0	0	0	0
NO	375	316	59	234
CH	1125	720	405	451
AL	187	129	58	33

Source: Eurostat.
Note: the numbers for France, Italy, Spain, Germany, the UK and Poland are in bold as a special focus is put on these countries

3.3.7 Future skills in environment- related industries in Member States

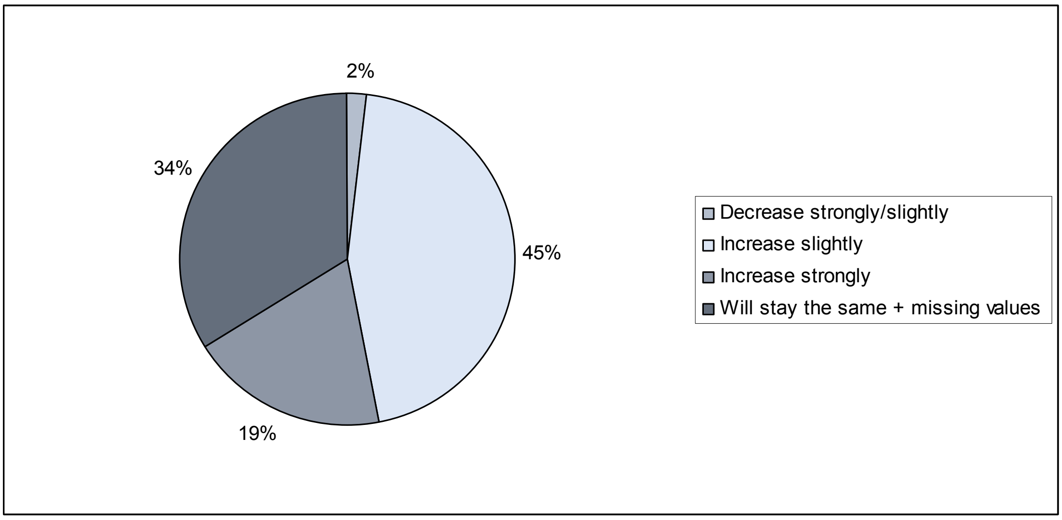
In an examination of the available literature on skills in environment-related industries in Member States, only information on the future skills in the renewable energy sector in Germany was found. This subsection discusses the expected speed of changes in skills in the renewable energy sector as well as the expected changes in general skills in the renewable energy sector.

Expected speed of changes in skills in the renewable energy sector[91]

Figure 3.7 demonstrates the expected speed of changes in skill needs in the renewable energy sector within the next three years. It thus shows the expectation of how fast skills in the renewable energy sector will change. As the figure shows, 45 percent of the firms expect that the speed of change in skill needs will increase slightly. 34 Percent (missing values included) of the companies expect that the speed of skill changes will stay the same. A strong increase is expected by 19 percent of the firms. Only 2 percent of the firms expect a decrease in the speed of change in skills (either strongly or slightly).

[91] Kuwan, H. (2008). ADeBar – Early recognition of skill needs by continuous observation at work and in companies. Future skill needs in renewable energies identified in an Integrated approach: results of the ADeBar project. Fraunhofer IAO. TNS Infratest. http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-Cedefop_hkuwan_iao_tns_5_10_2008.pdf

Figure 3.7 Expected speed of changes in skills in the renewable energy sector within the next 3 years (changes in % - 'will stay the same' and missing values not reported)

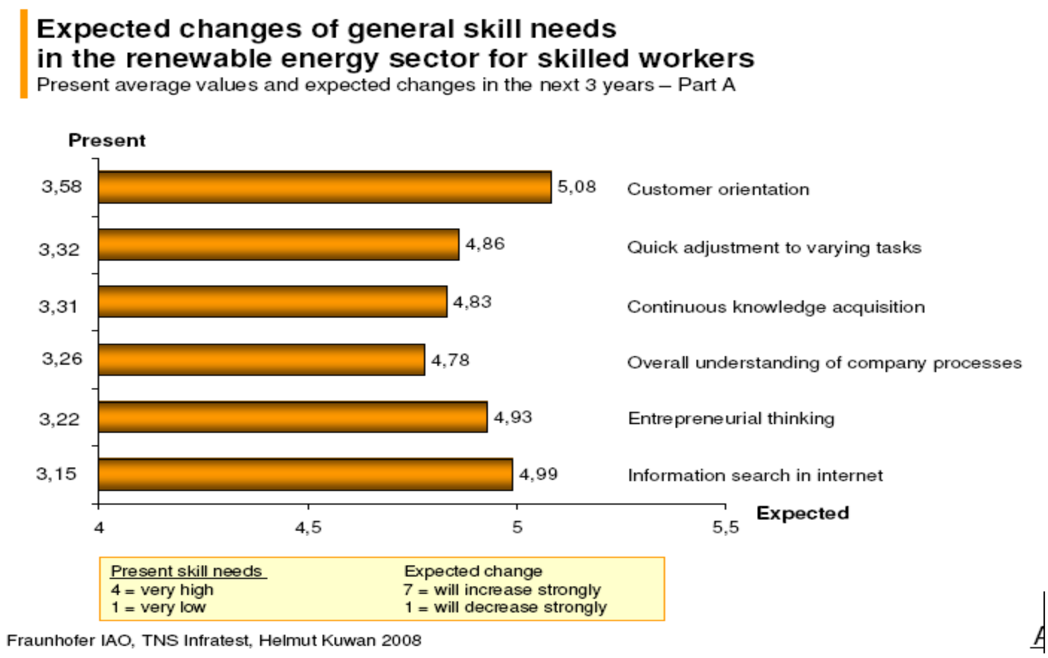


Source: Kuwan, H. (2008). ADeBar – Early recognition of skill needs by continuous observation at work and in companies. Future skill needs in renewable energies identified in an integrated approach: results of the ADeBar project. Fraunhofer IAO. TNS Infratest.
http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-Cedefop_hkuwan_iao_tns_5_10_2008.pdf

Expected changes in general skills in the renewable energy sector

The expected changes in general skill needs in the renewable energy sector for skilled workers within the next three years are shown in figure 3.8. As the figure illustrates, the current need for all the general skills is very high and this need is expected to increase quite strongly. The current need for the skill 'customer orientation' is the highest and is also expected to increase the strongest compared to the other general skills. The need for the skill 'information search on internet' is lowest now, but this need is expected to increase more than almost all the other skills.

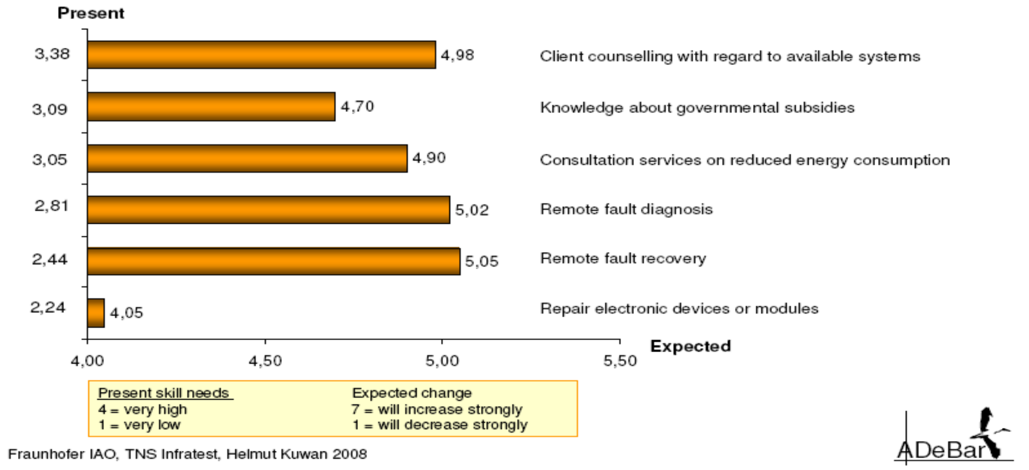
Figure 3.8 Expected changes of general skill needs in the renewable energy sector for skilled workers (Present average values and expected changes in the next three years)



Source: Kuwan, H. (2008). ADeBar – Early recognition of skill needs by continuous observation at work and in companies. Future skill needs in renewable energies identified in an integrated approach: results of the ADeBar project. Fraunhofer IAO. TNS Infratest.
http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-Cedefop_hkuwan_iao_tns_5_10_2008.pdf

Figure 3.9 shows the expected changes in specific skill needs in the renewable energy sector for skilled workers for the coming three years. The need for the skill ‘repair electronic devices or modules’ is moderate now and will increase least compared to the other skills. The current skill need for ‘remote fault recovery’ is relatively low, but it is expected to increase more than all the other skills. The need for ‘remote fault diagnosis’ will also increase very strongly. The current need for the skill ‘client counselling with regard to available systems’ is the highest compared to the other skills and will also increase strongly in the next three years.

Figure 3.9 Expected changes of specific skill needs in the renewable energy sector for skilled workers (Present average values and expected changes in the next three years)



Source: Kuwan, H. (2008). ADeBar – Early recognition of skill needs by continuous observation at work and in companies. Future skill needs in renewable energies identified in an integrated approach: results of the ADeBar project. Fraunhofer IAO. TNS Infratest.
http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-Cedefop_hkuwan_iao_tns_5_10_2008.pdf

Expected speed of changes in skills in the energy-intensive industries
A German study on energy-intensive industries states that there will be a shift towards jobs on the highest (master's equivalent) and medium levels of education (bachelor's degree and foremen/technicians)[92].

3.4 Mainstreaming of environmental skills and qualifications

There is hardly any information on how likely it is that environmental skills and qualifications will become a required attribute for employees regardless of their sector of employment.

However, as mentioned before, according to the OECD, the main characteristic of environmental job qualifications and skills is that they are traditional qualifications and skills applied to environmental issues. This would mean that there are no environmental qualifications, but that there are for example chemists working in the sectors of water or waste[93]. This is also argued by the Austrian Institut für Wirtschaft und Umwelt. In its study it states that the environmental goods and services industry (EGS industry) does not necessarily have different general qualification requirements compared to the general qualification requirements[94].

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92 ETUC (2007). Climate Change and employment. Impact on employment in the European Union-25 of climate change and CO2 emission reduction measures by 2030
http://www.tradeunionpress.eu/Web/EN/Activities/Environment/Studyclimatechange/rapport.

93 OECD Seminar Social and Environment Interface Proceedings (1999). http://www.oecd.org/dataoecd/51/15/33848718.pdf

94 OECD Seminar Social and Environment Interface Proceedings (1999). http://www.oecd.org/dataoecd/51/15/33848718.pdf

According to the UNEP study on green jobs, many existing jobs (i.e. plumbers, electricians, metal workers, and construction workers) are likely to be redefined due to the greening of day-to-day skill sets, work methods and profiles[95].

This shows that working in environment-related industries does not necessarily require a person to have neither environment- related skills nor a degree in environment-related studies. In theory, anybody who possesses the requested general skills could perform tasks within the environment-related industries. In a way this could be seen as mainstreaming of environmental skills and qualifications.

95 UNEP et al. (2008). Green Jobs: Towards decent work in a sustainable low-carbon world http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_098503.pdf

4 The success of environmental schemes in terms of creating employment

4.1 Introduction

As future employment and skills are important for sustainable growth, it is important that policy makers can give direction to this.

This chapter discusses the impact of environmental policies and environmental schemes on employment. The general opinion is that the impact of environmental policies on employment is neutral or slightly positive, but no robust conclusions on the impacts of environmental schemes can be drawn. Unfortunately there is hardly any information available on the effects of environmental policies and schemes on skills profiles, but the information presented here is still relevant for better understanding the expected employment effects and how this may link to skills that will be required.

4.2 Impact of environmental policies on employment - neutral or slightly positive

Studies undertaken by the OECD, the EC and many other sources tend to argue that environmental policies have a neutral or a slightly positive impact on employment[96]. The study 'facts and figures' states that no examples of job losses or regional difficulties caused by environmental policies exist[97]. The GHK study suggests that the effects of the environmental policies will be positive (at least in the short term) due to the boost in demand they cause in labour-intensive industries[98].

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96 Szovics, P., (2008), CEDEFOP, Future skill needs for the green economy, International workshop http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-szovics__future_skill_nedds_for_the_green_economy_6_7_10_2008.pdf, EC (2005). Commission Staff Working Document on the links between employment policies and environment policies. http://ec.europa.eu/environment/integration/pdf/sec_2005_1530_en.pdf, GHK et al. (2007). Links between the environment, economy and jobs. http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_report.pdf, European Commission (2007), Facts and Figures, the links between EU's economy and environment http://ec.europa.eu/environment/enveco/industry_employment/pdf/facts_and_figures.pdf, OECD (1999) Working Party on Environmental Performance, OECD Seminar Social and Environment Interface Proceedings (1999). http://www.oecd.org/dataoecd/51/15/33848718.pdf

97 European Commission (2007), Facts and Figures, the links between EU's economy and environment http://ec.europa.eu/environment/enveco/industry_employment/pdf/facts_and_figures.pdf

98 GHK et al. (2007). Links between the environment, economy and jobs. http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_report.pdf

However, it is intuitively clear that environmental policies will lead to a structural shift in employment towards greener industries. What is less clear is the magnitude of this shift, with many of the changes taking place in 'green shade' jobs instead of in core eco-industry jobs (for example, the shift to more energy efficient buildings within the construction sector).

According to an EC Staff working document, there are two policies in particular that are seen to have positive impacts on employment; the environmental tax reform and the promotion of environmental technologies[99]. A German study also discusses the influence of environmental policies on employment. This study on energy-intensive industries concluded that climate policies will not have an effect on jobs for low skilled workers[100].

When the EU Climate Package in January 2008 was launched by Commission President José Manuel Barroso, he stated that its goals (to decrease the CO2 emissions by 20 percent by 2020, raise the share of renewable energy sources in the energy mix and develop energy efficiency) could lead to the creation of thousands of "new businesses and millions of jobs in Europe". The 2006 renewable energy roadmap of the Commission confirms this by stating that there will be 650,000 jobs in the sector by 2020[101]. As citizens and political leaders see the climate as a cost rather than an investment, they are not fully convinced.

Emerging green economy and poor workers
There are about 1.3 billion workers in the world who are 'working poor'. 'Working poor' means that they are unable to earn enough to save themselves and their families from severe poverty. This forms a substantial challenge to the green-jobs future based on a 'just transition' worldwide[102].

As the UN recently argued, one of the dangers of the emerging green economy worldwide is that a lot of low-skilled, but environmentally-related jobs will trap the poorest workers in dirty and unhealthy low-pay work in sectors such as agriculture and waste-recycling.

4.2.1 The impacts of environmental policies on firm and aggregate level

Already mentioned in the introduction is the fact that data is severely hard to come by regarding the effects of environmental policies and schemes on skills profiles. However, there is more information on employment effects and is mentioned here as part of this employment effect will entail developing specific skills for workers. At firm level, environmental policy may have a positive effect on employment in the short and medium run if it succeeds in stimulating demand for environmentally friendly goods and services.

99 EC (2005). Commission Staff Working Document on the links between employment policies and environment policies. http://ec.europa.eu/environment/integration/pdf/sec_2005_1530_en.pdf

100 ETUC (2007). Climate Change and employment. Impact on employment in the European Union-25 of climate change and CO2 emission reduction measures by 2030 http://www.tradeunionpress.eu/Web/EN/Activities/Environment/Studyclimatechange/rapport.

101 Scott, J. (2008), E3G, Future Skill Needs for the Green Economy: Some Starting Points. http://www.trainingvillage.gr/etv/upload/etvnews/news/3800-att1-1-e3g_cedefop_070808.pdf

102 UNEP et al. (2008). Green Jobs: Towards decent work in a sustainable low-carbon world http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_098503.pdf

However, It might have a negative effect if constrains on the operation of firms are introduced leading to higher product prices and, subsequently, decreased demand for products. An example is promoting process-integrated technologies rather than end-of-pipe technologies. This may lead to more jobs if demand increases, but often ends up increasing costs which has the potential to negatively effect employment[103].

An OECD analysis of market based instruments (and especially the double dividend) in the context of climate change states that their impact on employment on the aggregate level is uncertain. A number of aspects need to be considered:

- even if the impacts on jobs are positive, job losses may still exist and sectoral shifts may take place;
- part of the created jobs may be for low-skilled people, who have a lower than average productivity per person. However, if the job creation is for unemployed people, the overall productivity of the economy and the average productivity per person will increase;
- employment is determined by a small number of factors in the long term: the size of the labour force, participation rates and the long run equilibrium rate of unemployment. The composition of employment may change due to employment policy, but it will hardly change its size.

In sum, the net impact of environmental policy on employment is probably neutral or even slightly positive.

Hypothetical employment policies and there impacts on employment

The GHK study looks at various hypothetical policies and models the impact of these policies on the nature and/or costs of inputs to a sector as well as on GDP and employment. According to this study, environmental policy merely causes a marginal reallocation of resources from the sectors that finance a policy to the sectors benefitting from the intervention. Examples are given in the table below:

Table 4.1 Hypothetical employment policies and there impacts on employment

	Output	Employment
10% decrease in purchases of inputs from the energy sector and substitution to more energy efficient technologies	+ €480m	+ 140,000 jobs
A 10% substitution of bio-fuels for manufactured fuels	+ €1.5 billion	+ 140,000 jobs
EU Structural funds should create an investment of €7 billion in environmental infrastructure per year.	+ €20 billion	+ 170,000 jobs per year (most of them will be created in **Spain**, Hungary, **Poland** and Romania)

Source: GHK et al. (2007). Links between the environment, economy and jobs.
http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_report.pdf

[103] EC (2005). Commission Staff Working Document on the links between employment policies and environment policies. http://ec.europa.eu/environment/integration/pdf/sec_2005_1530_en.pdf

Note: Spain and Poland are in bold as a special focus is put on these countries

Double dividend

Sometimes revenue-neutral green tax reforms are seen as a means to generate a "double dividend". The first dividend is in terms of more effective environmental protection and the second one in terms of for example an increase in employment when direct labour taxes are reduced. However, the double dividend hypothesis is not unquestioned. The "double dividend" is more likely to be generated in imperfect competition on labour market and product markets[104].

4.3 The effect of environmental schemes on employment – no robust conclusions possible

Job creation and social inclusion in the EU is partly achieved through environmental policies. This holds particularly true for new policies which support the development and use of new environmental technologies, such as the EU Emissions Trading Scheme and the Environmental Technologies Action Plan[105].

European Emissions Trading Scheme

ZEW, the Centre for European Economic Research, undertook a literature review on the impacts of the European Emissions Trading Scheme (EU ETS) on employment. According to the study, ETS has both positive and negative impacts on employment. The study states that not very robust conclusions can be derived from the studies analysed, as only two out of the six available studies are focusing on the EU ETS, and one of these two studies has been criticised for methodological mistakes. Furthermore, in almost all studies BAU scenarios rather than alternative regulation are used as a reference. By comparing the impacts of ETSs with the impacts of BAU, it can be concluded that a moderate decrease in employment takes place. However, compared to other alternative regulation methods to reach the Kyoto targets, the arrangement of the EU ETS is definitely one of the best choices due to its flexibility and due to the innovation incentives induced. The employment effects of the EU ETS will be smaller than many sectors representatives fear. There will be hardly any aggregated job losses (i.e. job losses on the macro-level); however, the mechanism will not create jobs either. There will be winners and losers at firm and sector level. Within some firms and sectors, workers will be made redundant, while other firms and sectors will recruit workers. The analysis further finds that even if the overall effect for the EU will turn out to be negative, the importance will be minor[106].

Cash-for-replacement schemes

The economic effects of cash-for-replacement schemes might be positive, especially if the country has a significant national car industry. An increase in GDP and employment might take place due to an increase in new car sales. However, this increase will only be

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[104] OECD Employment Outlook 2007, http://www.oecd.org/dataoecd/2/51/40776791.pdf

[105] EC (2005). Commission Staff Working Document on the links between employment policies and environment policies. http://ec.europa.eu/environment/integration/pdf/sec_2005_1530_en.pdf

[106] ZEW (2006). The Impacts of the European Emissions Trading Scheme on Competitiveness and Employment in Europe – a Literature Review http://assets.panda.org/downloads/zew_eu_ets_impacts_exec_summary.pdf

temporary and will probably come with negative counter effects such as a decrease in sales just before the introduction of a scheme and after the end of the scheme. Also, the increased expenditure on cars is likely to cause a decrease in the consumption of other durable goods. It is hard to make robust conclusions on the overall change in GDP and employment resulting from these effects[107].

The UK - government energy efficiency programmes: positive effect for long-term unemployed in socially disadvantaged residential areas

Only information on the effect of a scheme/programme on employment in one Member State, the UK, was found. The government energy efficiency programmes in the residential sector in the United Kingdom created jobs. The investments in energy efficiency included training to increase the skill levels necessary to carry out the work required. These jobs were mainly taken by long-term unemployed individuals in socially disadvantaged residential areas. In the HEATWISE project which was a project that focused on supplying thermal insulation to houses of disadvantaged families', and which also featured energy audit services and information, exchange of experience, and training campaigns on energy efficiency, 2,000 long-term unemployed received appropriate training, thereby increasing employability prospects considerably and for which there was a strong positive social impact[108].

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107 EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT COUNCIL OF MINISTERS (1999), CONCLUSIONS AND RECOMMENDATIONS ON SCRAPPAGE SCHEMES AND THEIR ROLE IN IMPROVING THE ENVIRONMENTAL PERFORMANCE OF THE CAR FLEET http://www.internationaltransportforum.org/europe/ecmt/environment/pdf/CM199926Fe.pdf

108 ETUC (2007). Climate Change and employment. Impact on employment in the European Union-25 of climate change and CO2 emission reduction measures by 2030 http://www.tradeunionpress.eu/Web/EN/Activities/Environment/Studyclimatechange/rapport.

5 Life-long learning activities of environmental employees

5.1 Introduction

Life-long learning is essential for countries to have access to the labour skills they require. Due to life-long learning and vocational training, employees gain the education, training and information that allow them to adjust to changing economic conditions and a changing labour market[109]. Education is also crucial for achieving the objectives of environmental sustainable development[110].

The degree to which life-long learning activities are pursued compared to other sectors is discussed in section 5.2 and 5.3. As there is not much information available (in general and on EUROSTAT) on life-long learning activities of workers in environment-related industries, section 5.2 is on the life-long learning activities of skilled agricultural and fishery, craft and related trades workers. Section 5.3 is on continued vocational education of employees in the 'mining and quarrying, electricity, gas and water supply, construction, hotels and restaurants, transport, storage and communication' sectors. Although some of the sectors are not directly part of the environment-related sectors, the numbers can be used as an indication. Therefore, this group will be called environment-related sector in this chapter. Again, a special focus is put on France, Italy, Spain, Germany, the UK and Poland.

5.2 Life-long learning in the environment-related sectors – less than in other sectors

In environment-related sectors life-long learning is considered extremely important. As mentioned before, according to the AK Wien study the step-wise upgrades of existing processes and machinery regularly go together with in-firm training and with an increase in the skills of employees and job quality[111]. Nevertheless, some of the low-tech waste management workers will not be automatically well-matched to any higher-tech jobs

109 ILO (1996). Trade Unions and Environmentally Sustainable Development . Booklet 6. Education And Training http://www.ilo.org/public/english/dialogue/actrav/enviro/trainmat/tuesd/6tuandes.pdf

110 ILO (1996). Trade Unions and Environmentally Sustainable Development . Booklet 6. Education And Training http://www.ilo.org/public/english/dialogue/actrav/enviro/trainmat/tuesd/6tuandes.pdf

111 Institut für Wirtschaft und Umwelt & AK Wien (2000). Environment and employment: sustainability strategies and their impact on employment,

created. Consequently, to be able to shift towards integrated technologies, attention needs to be paid to continuous training[112].

Life-long learning of skilled agricultural and fishery, craft and related trades workers: relatively low

The only information provided by EUROSTAT on life-long learning activities of workers in environment-related sectors is information on the participation of 'skilled agricultural and fishery workers, craft and related trades workers' in any life-long learning activities.
The participation of these workers in any life-long learning activities in 2005 is shown in table 5.1. As can be seen in the table, 'skilled agricultural and fishery workers, craft and related trades workers' in the EU pursue less life-long learning activities than 'managers, professionals, technicians and associate professionals' and 'clerks and sales'. However, they do pursue more activities than 'plant and machine operators and assemblers and elementary occupations'. The same is true for Germany, Spain, France, Italy, Poland and the UK.

Table 5.1 Participation in any life-long learning activities by occupation % (2005)

	Managers, professionals, technicians and associate professionals	Clerks and sales	Skilled agricultural and fishery workers, craft and related trades workers	Plant and machine operators and assemblers and elementary occupations
EU25	64.8	45.1	34.4	27.7
BE	64.7	46.3	32.7	28.2
CZ	52.4	27.7	20.2	19.2
DK	92.7	81.7	73.8	60.8
DE	**60.8***	**42.3**	**35.9**	**24.8**
EE	63.6	33.1	20.7	13.7
GR	37.1	20.9	8.9	8.3
ES	**43.5**	**28.2**	**14.8**	**14.7**
FR	**82.6**	**53.1**	**50.1**	**30.9**
IE	59.5	51.3	39.9	35.5
IT	**74**	**54.2**	**41.3**	**36.4**
CY	78.3	42.6	22.6	11.8
LV	75.6	50.4	39.8	31.6
LT	66.6	26.5	16.2	12.6
LU	93.6	87.9	71.4	69.8
HU	25.8	13.3	6.8	6.5
MT	67.2	60	54.8	48.4
NL	60.4	36.9	26.9	19.7
AT	93	86	82.4	80.7
PL	**67.2**	**36.2**	**21.3**	**20.2**
PT	69.1	54.3	33.5	32.9
SI	94.4	86.2	76.7	73

112 EC (2005). Commission Staff Working Document on the links between employment policies and environment policies. http://ec.europa.eu/environment/integration/pdf/sec_2005_1530_en.pdf

	Managers, professionals, technicians and associate professionals	Clerks and sales	Skilled agricultural and fishery workers, craft and related trades workers	Plant and machine operators and assemblers and elementary occupations
SK	79.3	64.8	58.3	58
FI	90.2	83.8	71	66.9
SE	86.6	67.5	56.8	49.9
UK	**57.2**	**44.2**	**26.8**	**22.3**
BG	47.5	14	8	6.5
RO	29.6	10	5.2	7.1
NO	52	34.1	27.5	22.6
CH	89.5	64.5	57.4	42.2

Source: Eurostat.

Note: the numbers for Germany, France, Italy, Spain, the UK and Poland are in bold as a special focus is put on these countries

5.3 Continued Vocational Training of workers in environment related sectors: less than other workers

EUROSTAT also provides information on participants in Continued Vocational Training[113] (henceforth CVT), as a percentage of employees in all enterprises by NACE (sector) in 2005. CVT is a form of life-long learning. The only environment-related sectors where data is provided upon can be found in the group 'mining and quarrying, electricity, gas and water supply, construction, hotels and restaurants, transport, storage and communication'. As mentioned before, although several of the sectors are not directly part of the environment-related sectors, the numbers can be used as an indication and, as a consequence, this group will be referred to as the environment-related sector in the remainder of this section.

Table 5.2 shows that, in the EU-27, one third of all workers in the environment-related sector participate in CVT and that this share is only higher for workers in 'manufacturing' and 'wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods' sectors.

In Germany, the share of workers in the environment-related sectors participating in CVT is only higher than the share in the 'wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods' sectors. In Spain, the share of employees in the environment-related sectors participating in CVT is only higher than for employees in 'other community, social, personal service activities' sectors. The workers in environment-related sectors in France participate much more in CVT compared to other countries, but also compared to French employees in other sectors. Only in the 'financial intermediation' sector a higher share of employees participates in CVT. The same holds for Poland. In the UK, the share in the environment-related sector is higher than in the

[113] There are many different forms of continuing vocational education: lectures, courses, seminars, workshops, etc. From http://www.bmbf.de/pub/continuing_vocational_education-flyer.pdf

sectors 'manufacturing' and 'wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods'.

Table 5.2 Participants in Continued Vocational Training as a percentage of employees (2005)

	Mining and quarrying; electricity, gas and water supply; construction; hotels and restaurants; transport, storage and communication	Manufacturing	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	Financial intermediation	Real estate, renting and business activities	Other community, social, personal service activities
EU27	33	31	26	57	35	36
BE	37	43	34	66	41	23
BG	19	13	11	42	14	8
CZ	63	60	47	78	58	54
DK	31	27	24	37	59	58
DE	**25***	**35**	**23**	**46**	**29**	**35**
EE	27	16	29	68	31	30
GR	10	12	18	43	13	4
ES	**31**	**33**	**31**	**67**	**35**	**22**
FR	**49**	**45**	**36**	**72**	**44**	**40**
IT	**28**	**22**	**28**	**73**	**34**	**23**
CY	32	23	25	63	32	15
LV	16	12	12	46	14	14
LT	16	12	11	49	19	11
LU	34	49	41	78	53	55
HU	25	12	13	38	10	10
MT	32	39	13	72	27	13
NL	36	33	26	54	36	30
AT	31	31	31	65	25	39
PL	**24**	**19**	**16**	**45**	**16**	**13**
PT	27	23	34	66	26	24
RO	16	18	14	58	19	13
SI	40	52	50	79	42	52
SK	44	37	38	75	22	19
FI	38	44	35	59	44	23
SE	44	49	45	51	43	50
UK	**33**	**29**	**20**	**43**	**42**	**48**
NO	23	28	30	47	33	40

Source: EUROSTAT.
Note: the numbers for Germany, France, Italy, Spain, the UK and Poland are in bold as a special focus is put on these countries

Table 5.3 gives information on the amount of participants in another form of Continued Vocational Training (CVT in work situation) as a percentage of employees in all enterprises by NACE and type of training. The table shows that the share of workers in environment-related sectors in the EU is solely higher than for those employed in the 'other community, social, personal service activities' sectors.

The same holds for Germany. No information is available on the UK. In Spain, the share of employees in environment-related industries that participate in the other form of CVT is higher than the share of employees participating in this CVT in the sectors 'financial intermediation' and 'other community, social, personal service activities'. Although it is only 9 percent, in Italy the share is highest in the environment-related sector and in 'real estate, renting and business activities'. This situation is also prevalent in Poland.

Table 5.3 Participants in other form of CVT as a percentage of employees in all enterprises by NACE and type of training: Continued vocational training in work situation (2005)

	Mining and quarrying; electricity, gas and water supply; construction; hotels and restaurants; transport, storage and communication	Manufacturing	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	Financial intermediation	Real estate, renting and business activities	Other community, social, personal service activities
EU27	14	17	18	20	15	10
BE	19	24	22	24	25	8
BG	10	13	9	29	13	6
CZ	28	37	27	53	30	26
DK	11	50	8	9	36	37
DE	**19***	**26**	**33**	**36**	**23**	**12**
EE	13	14	17	39	27	20
GR	4	3	4	4	6	1
ES	**16**	**19**	**28**	**14**	**19**	**11**
IT	**9**	**6**	**5**	**6**	**9**	**5**
CY	5	5	9	5	9	11
LV	10	7	5	12	5	5
LT	9	10	12	31	12	7
LU	23	35	13	14	36	20
HU	14	14	9	17	12	6
MT	17	22	6	34	14	17
NL	10	11	10	13	12	14
AT	6	10	14	9	5	6
PL	**19**	**14**	**14**	**17**	**10**	**7**
PT	10	7	12	6	12	7
RO	16	15	10	16	13	12
SI	23	25	10	16	12	8
SK	16	27	13	26	22	8
FI	16	17	17	21	19	5
SE	18	28	19	39	14	6
UK	-	-	-	-	-	-
NO	14	18	23	23	19	14

Source: Eurostat.
Note: the numbers for Germany, France, Italy, Spain, the UK and Poland are in bold as a special focus is put on these countries

6 Identification of Policy Levers

6.1 Introduction

The move towards a low-carbon economy is gaining momentum. However, for this move to develop further, an environmentally-skilled workforce is essential. This trend is manifested in the increased focus on the environment in education and training syllabi and more generally in the accompanying shift in Western popular culture. The awareness of the importance of a sound environment is increasing as economic and job development is increasingly reliant on healthy ecosystems and the related ecosystem services for sustained growth. Without a healthy environment that is able to provide the fundamentals of a functional economic system (i.e. an economic system embedded primarily in a closed ecological system) the modern world would cease to exist. Universally, this truth is being communicated in increasing frequency to policy decision makers, consumers, employers and other stakeholders that together form the society we live in. There is room for optimism in that these trends mean that the knowledge of environmental phenomena is being diffused throughout society and will ultimately provide the foundation of a suitably knowledgeable, skilled and qualified workforce in the future. This mainstreaming effect of the environmental movement is mostly played out in the long-term, but will require short-term action to get to a sustainable economy and society more quickly.

It is clear that the skills-gaps identified are in accordance with sectoral activity and that they are dependent on the local and national contexts. Furthermore, it can be seen that appropriate policies to address these skills shortages are required. Of course, the growth in many environmental-based jobs is itself *driven* by policy changes and new legislation at various decision-making levels. Consider for example the tax breaks, subsidies, etc. which help spawn new markets (greenhouse gas emission caps at EU level are a driver of investment in alternative energies). In approaching the issue of how to influence skills development so that employees are able to work in the environmental domain, it is essential to make sure that any policy action is coherent and reinforcing. In other words, it is important to create a stable investment environment through maintaining green subsidies so that employers will have the certainty that investing in environmental training for their employees is a logical and sustainable action to take. This type of joined-up policy-making is an example of how linking workforce training to economic development strategies can produce better environmental performance and further career prospects for workers.

The demand-led trend of increased investment in sustainability across different sectors of the economy is creating new opportunities for environmentally-related workers (either directly or indirectly). This can be viewed as a positive development as it lends an opportunity to not only high-skilled workers, but also to low-skilled workers to be re-trained or up-skilled to be able to start working in related fields that require "green-collar" workers. However, it can also be viewed as a negative development as one of the dangers of the emerging green economy is that (as the UN recently pointed out) a large number of low-skilled, but environmentally-related jobs will trap the poorest workers in dirty and unhealthy low-pay work in sectors such as agriculture and waste-recycling. Besides creating more environmental employment in the economy, policy should also be geared towards providing an alternative to this trend.

Based on the analysis of the literature, another trend has become clear: that the development towards a "greener" economy is not necessarily only likely to create *new* jobs (although this is certainly not excluded either); but that a lot of the "green" employment will result in adapting *current* jobs to match new green technological enhancements as well as in adding new "green skills" to existing occupations. Thus, to meet the demand for environmental skills that is emerging in the new economy, it will become necessary to expand education and training options for workers and for the currently unemployed.

This chapter will aim to identify policy levers that will address the skills-gaps that have been outlined in this report. Furthermore, this chapter will discuss policy options that can close this gap, possibly by influencing the amount of *investment* in skills and learning in order to achieve the necessary environmental performance benefits; or alternatively by initiating a broad-based environmentally-relevant education policy; or by developing a strategic framework for locally-based solutions involving stakeholder partnerships to tackle skills shortages for the green economy. The basis of this task will be derived from the literature review that has been the crux of the research on the linkages between environmental performance and skills profiles of workers.

6.2 Various problems require varied solutions

Given the fact that the research has uncovered a variety of skills-shortages across different Member States and across different sectors of the European economy (for example see section 3.3.4 of this report describing skills shortages in the U.K. and Germany), it is clear that there will not be any one-size-fits-all policy that will be able to solve all skills-shortages problems simultaneously. Moreover, environmental-based jobs tend to be *local* jobs as they usually involve transforming or upgrading the natural and built environment (e.g. installing solar panels, constructing electricity distribution networks, landscaping, etc.). As a lot of environmental jobs are in manufacturing, construction, maintenance etc., skills shortages are related to positions held by traditional workers that do not have the extra environmental credentials needed to make the step over to greener versions of their occupations.

The example of the U.K. highlights that the skills problems are multifarious. At the same time, however, the research showed that policy action was taken in the U.K which helped alleviate the problem locally. The policy action in this case was investing in energy efficiency programmes in the residential sector, but crucially tying this investment to the re-training of construction and maintenance workers, specifically in the thermal insulation needs of the local housing stock. Thus, this policy combined an environmental scheme with training and education policy at the local level producing positive results for both local employment and for environmental improvement. At the same time, other sectors (the retail sector in the U.K. for example) are suffering what appears to be a similar trend: namely that the traditional skills are not sufficient to allow a move to a greener-based version of that job (in the U.K. case, retail staff cannot "sell" an environmentally-relevant product as they lack the skill to do so). However, the same policy that worked for the re-construction of local housing cannot necessarily be applied to the retail sector as the type of worker in the retail sector may be very different (e.g. a student, part-time worker, etc. without the "traditional" skills that a construction worker has). Hence, this shows the nature of the skills problem is non-uniform and is sector-dependent.

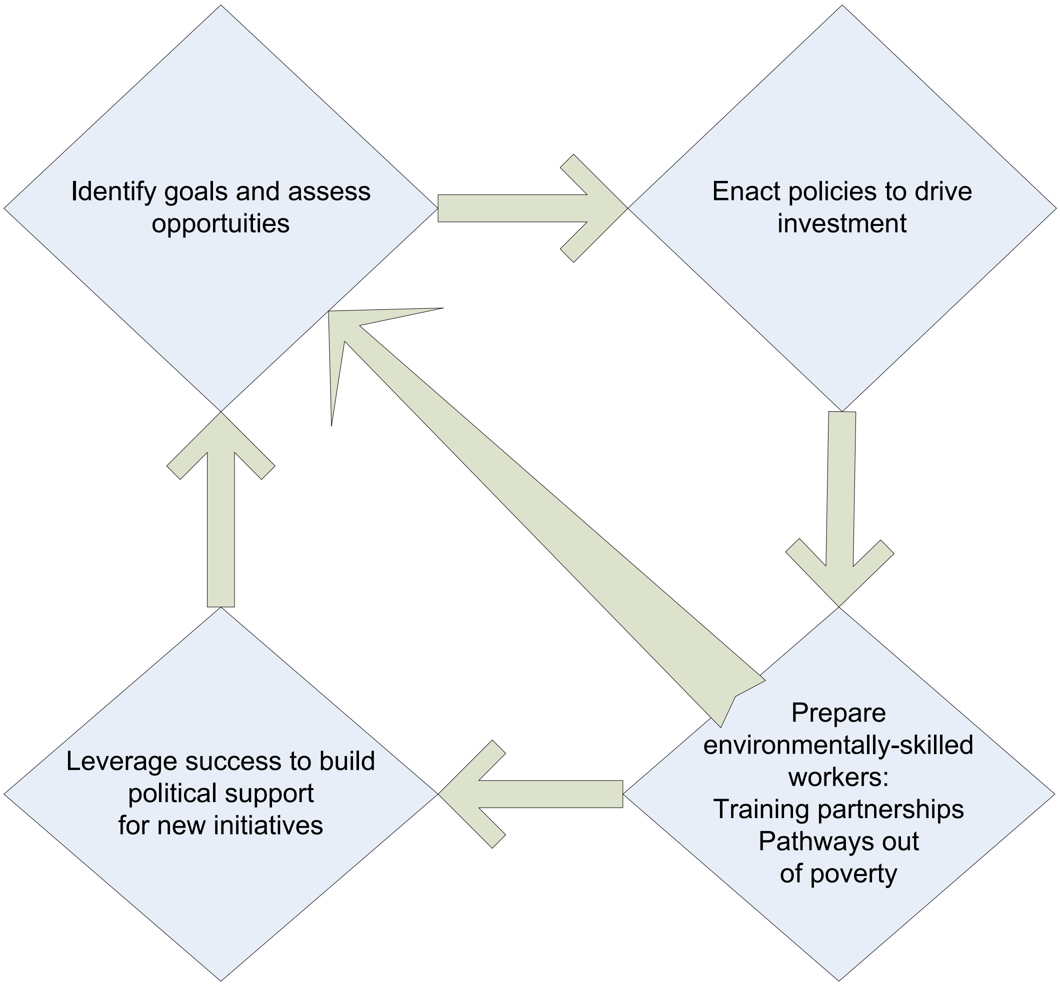
This non-uniformity is applicable across Member States as well as across sectors, and is a good reason for policy-making to be tailored to specific circumstances and contexts. It also implies that at larger scales of policy-making (such as at EU level), the onus has to be on driving the green economy forward and providing a framework where national, regional and local authorities can understand the need to provide the training and employment opportunities for environmentally-skilled workers in order to fill demand. This also implies that local economic strategies are key to making sure there are sufficiently trained workers that can supply the labour needed to enable the greening of skills at local levels. In other words, the demand-led approach that can be facilitated by policy and legislation at higher decision-making levels will have a trickle-down effect whereby local supply of labour with adequate know-how and skills is stimulated accordingly.

6.3 Stimulating environmental-skilled jobs

As has been discussed, the policies most likely to be effective are those that have been designed to meet unique situations in varying contexts (i.e. varying sectors and Member States). In order to make a coherent policy choice, it is necessary to develop a strategy or framework where these particular needs are identified and targeted for improvement. Figure 6.1 depicts a simplified flow chart of how demand-driven opportunities can result in a better-prepared workforce through identifying goals and opportunities in the sector or the locality concerned.

Figure 6.1 shows that it is necessary to identify environmental and economic goals, and assess local, regional and sectoral opportunities for achieving those goals. The next step is to make sure that appropriate policy drives investment into targeted environmental activity (such as the case of insulating investment and retraining in the U.K.), which increases demand for local environmentally-skilled workers. Following on from this, it is necessary to develop training programmes that will fit into the needs identified by the targeted environmental investment programme, which can be done by working with key employers and local government on suitable partnerships for training purposes. The success of the programme can be used to leverage more support for similar or wider-spread policies and initiatives. The key to developing the right skills is the training that is provided, but crucially it also depends on the realisation that workers can have access to good, permanent jobs with opportunities for career development.

Figure 6.1: Flowchart depicting the linkages between investment and job opportunities in the green economy



The national policy context is important and should provide a stable investment climate for the green economy, which in turn will make it clear to regional and local employers that they must work together with partners to provide the training that is necessary to succeed. Furthermore, sectors that are key to achieving sustainable development should be targeted for identification of their skills-needs and subsequent training programmes as it is through these sectors that sustainable development will be enhanced the quickest and most efficiently.

The EU finds itself in a position where the enactment of policy and legislation has been very successful in driving large amounts of investment in new technologies, fossil-fuel alternatives and the like, but is finding that skills-needs are not being met in various sectors (if drawing parallels with the flow chart in figure 6.1). In order to counter this, the training initiatives that will supply the skilled pool of labour need to work in conjunction with the economic development strategy of the locality or region, and should not be a stand-alone mechanism. In addition, national governments can give a clear signal of the intention to support initiatives being developed at local levels; with public money made available for environmental training programmes for example. Furthermore, environmental worker training programmes should provide entry points for a range of skilled workers, i.e. low-skilled and high-skilled alike. Each of these future workers needs a different kind of support to get started on a career pathway in the green economy. Some workers may need financial aid, or out-of-office-hours training to help them, while others may need help learning soft skills (such as in the case of the U.K. retail sector for example), including customer service skills, interview skills, etc. Job placements and internships should be made available to those who would benefit from this kind of training while others may need a more thorough and targeted conventional-skills training course to succeed. The point to be made here is that training happens at a local level and so it is essential that this training reflects the actual needs of the locality or region, and is why identifying opportunities in the local green economy is a good starting point for effective policy intervention.

What is of paramount importance in the provision of an adequately-skilled labour force is varied stakeholder involvement in identifying current and future labour shortages, in designing training curricula based on actual workforce needs and in hiring people to complete the training. At the local level, organisations that should be included are labour unions, local development organisations, community-based initiatives, local authorities and employer representatives. Targeting the right sector to be developed is also of vital importance as developing a green economy is reliant on local industry and the needs that industry has in terms of labour shortages and skills requirements. Partnerships at the local level can be organised in different ways depending on the context; either by industry, such as energy efficiency for example, or horizontally by sector.

6.4 Conclusion

On the basis of the research conducted for this assignment, it is possible to deduce that short term action in terms of policy making should focus on identifying skills-gaps in the local, regional, national or sectoral context and working from this departure point to be able to take suitable and efficient measures. Identifying skills gaps in the sectors that are key to achieving sustainable development is also an effective way to achieve good results. Although broad-based awareness-raising (educational) policies are beneficial (especially in making future employees and employers aware of the environmental skills that will be necessary to succeed in the workplace of the future), concrete measures to bring the skills-base up to date with the process and technological-driven adaptations that make for a greener economy are best taken in conjunction with creating real employment opportunities, generating career prospects in the green economy and providing real incentives for developing appropriate environmental skills.

7 Identification of possible future analysis

7.1 Introduction

Lack of information on future skill needs and emerging new skills has been a long-standing concern in Europe[114]. The need to anticipate skills and occupational needs is a priority in the Maastricht and Helsinki communiqués[115], the integrated guidelines for employment for 2005-2008[116] the European Social Fund for 2008-2010[117] and the Social partners' framework of actions for the lifelong development of competencies and qualifications[118]. The recently adopted Council resolution on new skills for new jobs[119] draws attention to the practical steps that need to be taken in education and training to provide citizens with better opportunities to succeed on the labour market.

The need to improve transparency on European labour markets, increase the skill levels of populations and prevent skill mismatches make information about the future development of skills and competences indispensable. Relevant findings could help achieve the objectives set in European employment and lifelong learning strategies and are essential for developing a European knowledge-based society. New and changing skill needs are challenges for policy-making to achieve wider social and economic objectives of cohesion and competitiveness in the European Union.

The Cedefop study, "Future skills needs analysis in Europe, medium-term forecast", presents a comprehensive medium-term forecast of employment and skills needs across the whole of Europe. It develops macroeconomic projections and alternative scenarios for each Member State[120] and aggregate results at European level. It provides data on future employment developments by economic sector, occupation and qualification until 2015 and uses comparative data for all Member States. It is this kind of work that can be applied to the development of the eco-industry across Europe as well, with the emphasis on a coordinated, structured analysis of the skills needs in various sectors and countries.

This chapter briefly examines the work that cone be done to further investigate the links between skill-needs and the environment and is based primarily on the preceding chapters of this report.

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114 Cedefop , *Future skills needs analysis in Europe, medium-term forecast,* Thessaloniki, 2008

115 http://ec.europa.eu/education/policies/2010/vocational_en.html
http://ec.europa.eu/education/policies/2010/doc/helsinkicom_en.pdf

116 http://eur-lex.europa.eu/LexUriServ/site/en/oj/2005/l_205/l_20520050806en00210027.pdf

117 http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_210/l_21020060731en00120018.pdf

118 http://www.etuc.org/a/580

119 http://eur-lex.europa.eu/LexUriServ/site/en/oj/2007/c_290/c_29020071204en00010003.pdf

120 EU-25 plus Norway and Switzerland.

7.2 Missing Data

Based on the thorough analysis of the literature as described in this report it has become clear there are a number of areas that are missing data or even a qualitative description regarding skills needs. These are usually related to (sub) sectors within certain Member States, but certainly there is no consistent approach to data gathering on skills deficiencies and needs related to environmental-related occupations across Europe; and is actually one of the main conclusions of this report, i.e. that the literature on the skills needs of environmental-related occupations is non-uniform and dependent on sector and geography.

How countries in Europe gather data on skills profiles and projections for the future is therefore a starting point for any analysis that aims to investigate European-wide skills shortages and needs in the eco-industry and beyond. Currently, there is no dedicated council at European level that collects and analyzes data on skills needs of the European labour force. Eurostat compiles data on some skills (e.g. e-skills), but there is no systematic European-wide approach to skills data collation, while also The European Centre for the Development of Vocational Training (Cedefop) is an important coordinating body for knowledge sharing on vocational educational matters. Cedefop plays an important role, but it is a decentralized agency aiming to promote a European area of lifelong learning throughout an enlarged EU. It does this by providing information on and analyses of vocational education and training systems, policies, research and practice. Cedefop's tasks are to compile selected documentation and analyses of data; contribute to developing and coordinating research; exploit and disseminate information; encourage joint approaches to vocational education and training problems; provide a forum for debate and exchanges of ideas. The EU *is* currently busy trying to make sure that consistent data gathering on skills in general is taken up by Member States, and is investigating various vehicles to achieve this (for example the setting-up of Sectoral Councils – see 7.3, next section). While this is taking place it is essential that any such mechanism is designed to include the environmental skills data too, and is most likely to do so, although it is re-emphasized at this junction.

Data sets that are collected in similar ways and are designed with a common purpose makes for a much more useful tool than is the current situation where data is spread across various sources and is described in divergent ways, therefore making comparative analysis difficult. Thus, any move towards centralizing and harmonizing data that is collected structurally would be a welcome improvement.

7.3 Sectoral Councils

A possible method to achieve a more robust data-set regarding skill - profiles, - needs, and future requirements for environmental work is through the creation of dedicated EU-level Sectoral Councils on employment and skills. Commission staff working documents on the possible setting-up of such councils emphasises that these should constitute a practical tool to pool together and exchange existing information on the topic as well as on the role this structure could play in feeding the sectoral social dialogue. Currently, every EU-country has sectoral or vocational councils who are involved in the development of job profiles, which can be approached for in-depth information, but a dedicated forum for employment and skills in each Member State would mean that further analysis could be performed based on a well-equipped and structural approach. In addition Sectoral Councils (SeCos) would be expected to make significant contributions to:

- enhancement of the co-ordination of research on skills needs across the EU in specific sectors;
- consolidation of available labour market and training information in EU's Member States;
- intensification of the exchange of views and information between main actors in a sector;
- provision of tools for policy makers across the European Union.

The final goals of these councils would be to achieve:

- a better adequacy of the supply of training to the demand for skills in view of:
- reducing the skills mismatches resulting in skills gaps and shortages;
- reduce unemployment;
- improve business performance;
- improve the skills level of the EU workforce.

Combined, these contributions will help to (a) bridge the skills gaps at sectoral level, (b) reduce unemployment, (c) improve business performance, and (d) improve the skills' level of the EU work force.

7.4 Expert opinion and skills projections

Environment skills are demanded by employers in different sectors and in particular by the eco-industry; and usually for a variety of occupations with inherently diverse skills profiles. Gauging the projected skills profiles of the labour force is important to advise government policy where to focus education policy now such that enough competences will be supplied to the labour force to meet demand in the future. An important source of information is based on consultations with sector representatives and experts while a comprehensive review of research carried out by or on behalf of these types of organisations provides a good basis as well. Despite these sources of information, the evidence base remains incomplete as there is often very good material for some sectors and much less available for others. Thus, there is always a need for new surveys that can target specific areas of the labour force. This process is carried out in many EU countries for informing government about skills of the labour force in general, and is either the responsibility of a dedicated government agency or that of a NGO. Methodologies that are used to make such a projection of skills needs vary between Member States, but in essence rely on a series of stakeholder dialogues. New surveys are often commissioned specifically to provide information not usually available from the existing national sources. These surveys are generally aimed at employers and seek to establish information on the current situation. In some case they also include questions about the future. The main emphasis tends to be on identifying skill shortages or skill gaps.

A number of different types of survey can be identified to help draw an adequate picture of skills profiles, projections and deficiencies:

- Employer surveys: these is usually a fairly straightforward survey aimed at providing basic data on employment levels and patterns as well as the patterns and scale of any skill deficiencies;
- Skills surveys: these type of survey is more intended to reveal information on the nature of skill deficiencies, including the needs for specific types of key, technical and generic skills;
- Workforce surveys: in some cases it has also been felt important to address the supply side and to survey the workforce rather than employers;
- Qualitative/opinion surveys: in a few cases survey methods have also been used to obtain more qualitative data about trends the current position and future possibilities. More frequently such information has been obtained in other ways.

As evidenced in this report, there is a growing body of evidence about skill requirements within different sectors usually compiled from the work of various sectoral bodies and training organisations. A possible future analysis would be to carry out tailored surveys, to provide a European-wide representative overview of the skills that will be required in order to be a greener, more efficient European society. The scale of such a task is probably beyond the remit of a one-off survey at EU-level, but instead will require a coordinated effort at national level, between the various skills and training councils that have experience in collating this information in their respective countries.

7.5 Environmental Schemes

Addressing skill gaps to supply businesses with appropriately skilled staff is often carried out by means of specialised programmes which aim to provide workers with the knowledge and skills that are needed in a locality or sector. Such programmes aims to support businesses and local economies identify the skills needed to succeed. Sometimes such schemes are targeted at graduates or sometimes at retraining traditional workers with new skills; but either way aims to build a stronger work force by supplying employees with the knowledge, skills and enthusiasm to drive forward new initiatives and policy. These schemes thus take various forms and are specific in targeting local or sectoral problems, but the point is that there are very many of them, and some are successful while others are less so.

The amount of environmental schemes focussed on environmental skills improvement for sustainable development etc. across Europe is difficult to assess, as they occur at local, regional and national levels. It has been beyond the scope of this report to analyse the actual effects of even a small sample of such schemes that have been set up across Europe[121], but may be an excellent source for analysis in the short term and as a next step to the current study. This would provide answers to the question of what the effects and impacts have been of such schemes that have actually taken place. Questions to be asked would include what the magnitude of the investment for the scheme was? How many

[121] a couple of examples have been discussed in this report, e.g. the U.K. and retraining schemes for construction workers.

employees benefited from the scheme? How many of these found jobs once they had left the scheme (sustainability) etc. A problem with this method is that a lot of schemes are not set up as a green-skills investment as such, but is rather indirectly related to green skills: the example of the UK scheme mentioned was about energy efficiency and construction techniques for example. Thus, it will be necessary to draw up a list of criteria that can establish when it is possible to speak of an “environmental scheme”, and use this as a departure point to analyze the effects and impacts of such a scheme. It also makes it harder to identify the types of schemes that would be interesting and relevant, though a local works council may well have access to information about the nature of the local employment schemes in a given region.

7.6 Education and labour markets

The identification, analysis and forecasting of skills needs is a key element of developing sound policy to increase the functioning of labour markets and the competitiveness of companies. For this reason it is not surprising that future skills requirements have received increasing attention in the framework of the EU Lisbon Strategy. Knowledge has become the major factor for economic productivity. Basically, knowledge and productivity are related in two ways: through research and innovation processes leading to the creation of new knowledge and its application in new (or better) products and services; and through education and training leading to a skilled labour force better able to produce and apply knowledge and information.

In light of the results of the research conducted for this report it has become clear that skills deficiencies exist between the requirements of employers and the training of undergraduates. The acuteness of the problem appears to be greatest concerning employers that hire from a newly graduated pool of inexperienced employees, suggesting that over time the majority of these skills are developed. However, graduates are not always able to recognise what they can actually do, or realise they need to apply their skills in the workplace. Many employers appear dissatisfied with the current level of skills offered by graduates and others completing academic programmes prior to work. Research indicates that some employers in particular professions such as information technology, law and accountancy often choose graduates from other academic disciplines because of their other skills, as opposed to their vocationally-specific skills gained during an undergraduate programme. Employers appear to prefer to train graduates in their own ways, looking for proven generic social skills rather than vocationally specific ones.

Leading on from this view point, it may well be informative to look at how green skills are being developed at the early stages of education and training of workforces, and examine what is being taught in syllabi across European schools and higher educational establishments in connection with environmental knowledge. What kind of knowledge is it? Is it academic rather than practical? Is awareness of environmental phenomenon translated into practical means to equip a future workforce? An analysis of how different countries target or remedy the deficiencies of the skills required for environmental jobs through education and training will be useful for bench-marking and comparative analysis, while a correlation may be found between successful education and training content, structure, facilities and institutions and the environmental performance of different countries. In order to make a feasible analysis, it may be useful to perform a European-wide communications survey to investigate the perception of students, teachers and parents on environmental knowledge and skills development and whether it is important to them and whether there is enough focus on environmental phenomenon in schools. Although this analysis bears some similarities with analyzing the effects of environmental schemes, this analysis will be focussed on educational stakeholders, and will be perception-based, rather than measuring impacts of schemes on employment and skills development.

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Annex 2: Workshop on future skill needs for the green economy

Background to the workshop

Cedefop's international network on early identification of skill needs – Skillsnet – supports informed policy-making. It is a platform for dialogue and information exchange on new and changing skill needs. Skillsnet takes a medium-term outlook for skills on the labour market, anticipating skill needs in Europe at macro level using forecasting techniques and at micro level through employer surveys.

Cedefop and Skillsnet also identify new and emerging skill needs in specific sectors. Sectors examined so far are tourism, nanotechnology and agri-food and forestry-wood chains, health care. Now the focus is on the skill needs in the green economy.

Workshop rationale

A key issue for policy makers and stakeholders dealing with climate change is how to reduce greenhouse gas (GHG) emissions through energy efficiency and alternative forms of energy and transport. Mitigation technologies, policies and measures are designed at national, European, international and sector levels. They include energy, construction, agriculture, manufacturing and transport.

Green technologies offer the possibility of new green jobs for those who respond quickly to the developing green economy. New green jobs will require new skills in new and emerging occupations. Identifying what those skills will be may make action to combat climate change more effective.

Everyone needs to be involved in mitigating climate change. Efficient coordination of measures in Member States, regions and communities is vital to keep costs low. The EU plays an important role in supporting action to adjust to climate change by fine-tuning policies, filling knowledge gaps and coordinating strategies.

The workshop will address the following questions:

1. What are the main trends and mechanisms that are restructuring Europe's green economy? Which specific and general skills are new and emerging and which are declining?
2. Which occupations are needed to mitigate climate change and what policies (national or EU initiatives) should be designed to meet the demand for green occupations?
3. How to develop education and training systems to respond quickly to continuously changing requirements? How to bring closer educational and training standards to occupational standards and employer priorities in green jobs?

Workshop objectives

The workshop will identify and increase knowledge about the implications of climate change for educating and training professionals and associate professionals who will be involved in mitigating climate change. Relevant professionals include natural resource managers, science and engineering professionals, especially physical and earth science professionals, life science professionals, architects, planners, surveyors and designers. The main focus will be on energy efficiency and renewable energy implementation skills determining the core element of future green jobs.

Key trends and future skills and occupational requirements will be examined. By doing so, the workshop will support evidence-based policy-making at national and European levels.

Agenda

	Monday, 6 October 2008
09.00-09.30	**Registration of participants**
	Chairperson: *Manfred Tessaring* (Cedefop)
09.30-11.00	**Welcome and introduction** *Manfred Tessaring,* Cedefop
Workshop rationale and objectives *Peter Szovics,* Cedefop	
Skills for green jobs and sustainable development *Christine Evans-Klock,* ILO **Impact on employment of climate change mitigation measures in the EU-25** *Sophie Dupressoir,* ETUC **Discussion**	
11.00-11.30	*Tea/Coffee break*
	Chairperson: *Alena Zukersteinova* (Cedefop)
11.30-13.00	**Skill needs for green jobs and sustainable development**
Skills for sustainable development: necessary but not sufficient? *Malcolm Rigg,* Policy Studies Institute, UK **Emerging skill needs in a greener UK economy** *Terence Hogarth,* University of Warwick, UK **A model for the education and training of ecologists and environmental managers in the UK: filling the skills gap** *Max Wade,* RPS Group Plc, UK **Discussion**	
13.00-14.30	*Lunch*
	Chairperson: *Torsten Dunkel* (Cedefop)
14.30-15.30	**Changing qualification needs in jobs for renewable energies**
Future skill needs in renewable energies identified in an integrated approach: results of the ADeBar project *Helmut Kuwan,* HK Forschung, DE **Curriculum development for green jobs in the biomass production for energy purposes** *Ladislav Nozdrovicky,* Slovak Agricultural University in Nitra, SK **Discussion**	
15.30-16.00	*Tea/Coffee break*
	Chairperson: *Peter Szovics* (Cedefop)
16.00-17.30	**Discussion in three parallel focus groups**
This session will address the key opportunities and challenges facing green jobs, in particular future skills needed for professionals in the green economy. *Moderators and rapporteurs:* *John McGrath*, Training and Employment Authority, IE *Clive Walmsley*, Countryside Council for Wales, UK *Olga Strietska-Ilina*, Skillsnet	
19.00	*Guided tour of the city*
20.00	*Dinner at Restaurant Panellinion*

Presentations

- ILO green jobs initiative and implications for skills development - Christine Evans-Klock (size: 242kb)
- Impact of climate change mitigation policies on employment in the EU - Sophie Dupressoir (size: 167kb)
- Skills for sustainable development: necessary but not sufficient? - Malcolm Rigg (size: 557kb)
- Emerging skill needs in a greener UK economy - Terence Hogarth (size: 219kb)
- A model for the education and training of ecologists and environmental managers in the UK: filling the skills gap - Max Wade (size: 964kb)
- Future skill needs in renewable energies identified in an integrated approach: results of the ADeBar project - Helmut Kuwan (size: 530kb)
- Curriculum development for green jobs in the biomass production for energy purposes - Ladislav Nozdrovicky (size: 902kb)
- Future skills needs for the green economy: some starting points - Jesse Scott (size: 45kb)
- Future skills needed in renewable energies in Spain: a vision of enterprises - Javier Gomez (size: 1266kb)
- Environment and labour force skills - Allister Slingenberg (size: 66kb)
- Future skill needs for the green economy - Peter Szovics (size: 215kb)
- Focus group reports (size: 74kb)
- List of participants (size: 61kb)