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COMMISSION STAFF WORKING DOCUMENT

Exploiting the employment potential of green growth

Accompanying the document

**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE REGIONS**

Towards a job-rich recovery

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TABLE OF CONTENTS

1.	Introduction	3
2.	Defining and measuring 'green jobs'	4
3.	Labour market challenges to developing a green economy	5
3.1.	Drivers influencing the rate of employment creation	5
3.2.	Sectoral developments affecting job creation prospects	6
3.3.	Managing labour shortages and skills transformation	9
3.4.	Securing sufficient levels of investment	14
3.5.	Job quality	15

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1. INTRODUCTION

The gradual transition towards a competitive, low carbon and resource efficient economy is above all an opportunity to minimise the negative consequences of climate change and resource depletion for future generations. In the current recessionary context, this shift also represents an unprecedented chance for the EU to reconsider its traditional economic model based on labour and capital productivity and begin a move towards a new one founded on the principle of **resource efficiency**. Transforming our economies will bring advantages in terms of enhancing energy security, improving the health of European citizens and boosting international competitiveness of EU industries. In relation to employment, many new jobs will be created and redefined while others might be lost.

The right choice of employment and skills policies can make an important contribution to realising this vision by capitalising on new possibilities and at the same time addressing existing bottlenecks. It is therefore essential that labour markets and associated policies at EU and Member State level act as a catalyst and not an obstacle that could halt this transformation process. Governments will need to engage public and private actors, mobilise existing resources and financial instruments at European and national level to ensure that policies are backed up by funds to business, entrepreneurs, workers and the research community so that new companies and jobs can flourish. Whilst freeing up credit and building consensus might seem like a difficult choice at present, all stakeholders must perceive this shift as a medium to long term development that will require resolute short term action if it is to succeed. A **unique opportunity** is therefore before Europe to leap into a new economic era of competitiveness.

This Staff Working Document informs and advances an on-going strategic reflection process on how to build a competitive, low carbon and resource efficient economy in line with the Europe 2020 Strategy. Employment policies are only a piece in a bigger puzzle but in depth discussions and **smart articulation of tools and policies**, including the European Employment Strategy, can go a long way in tackling the challenge. The emphasis placed on the transition towards a greener economy in worldwide fora (G20, ILO, UNEP – Rio+20, OECD) also calls for the EU and its Member States to provide clear and credible answers on this front.

As a follow up to the EU flagship initiative on new skills and jobs¹, the December 2010 EPSCO conclusions², the conclusions of the informal European Council of January 2012³ and the report by the European Parliament⁴, the Commission has undertaken research on how to build a competitive low carbon and resource efficient economic model. The results of this work have been used to feed into this Staff Working Document.

¹ COM (2010) 682 final, *An Agenda for new skills and jobs: A European contribution towards full employment*, available at:

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0682:FIN:EN:PDF>

² Doc. 18131/10, available at: <http://register.consilium.europa.eu/pdf/en/10/st18/st18131.en10.pdf>

³ Statement of the Members of the European Council of 30 January 2012, available at:

http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/127599.pdf

⁴ European Parliament (2010), *Report on developing the job potential of a new sustainable economy (2010/2010(INI))*, A7-0234/2010, available at:

<http://www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P7-TA-2010-0299&language=EN&ring=A7-2010-0234>

2. DEFINING AND MEASURING 'GREEN JOBS'

Development of a competitive, low carbon and resource efficient economy will bring about a fundamental transformation in terms of business processes and related skill sets, whilst also giving rise to so-called 'green jobs'. In the longer term, many of existing jobs will be transformed into 'green jobs'. In this context also the concept of 'green jobs' could refer to each sector of the economy and not only to certain sectors such as renewables or energy efficiency. This paper understands 'green jobs' as

...covering all jobs that depend on the environment or are created, substituted or redefined (in terms of skills sets, work methods, profiles greened, etc.) in the transition process towards a greener economy.

This broad definition is complementary and not opposed to the one coined by the United Nations Environmental Program (UNEP)⁵. For instance, additional employment will be **created** through increasing of the renovation rates of buildings, development and deployment of new technologies such as renewables or carbon capture and storage, some employment will be **substituted** as manufacturing of hybrid cars gradually replaces production of traditional cars, and existing jobs will be **redefined** as gas-fitters move towards installing gas combined heat and power instead of traditional systems or the builders constructing new buildings would move to the retrofitting business⁶, etc.

Several difficulties exist when measuring 'green jobs' defined that way primarily because these are not a clearly delineated part (and certainly not a sector) of the labour market. In terms of the skills that these jobs require, these are not necessarily distinct from many existing skills, and empirical data shows that skill requirements for jobs associated with a competitive, low carbon and resource efficient economy can already be found in existing occupations. Therefore, it would be safe to assume that **specific skill sets will evolve as jobs change** and adapt to new business practices. Finally, the very concept of a 'green job' is a moving target, since virtually every new product is greener than the one it replaces and involves more intelligent use of resources, changes in production processes and associated skills and technological evolution, all of which affect training and education curriculums.

At EU level Eurostat collects data on the so-called "eco-industries" (i.e. environmental goods and services sector (EGSS)⁷. This measurement is more limited than the abovementioned

⁵ UNEP defines green jobs as positions in agriculture, manufacturing, construction, installation, and maintenance, as well as scientific and technical, administrative, and service-related activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect and restore ecosystems and biodiversity; reduce energy, materials, and water consumption through high-efficiency and avoidance strategies; decarbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution.

⁶ UNEP/ILO (2009), *Green Jobs: Towards decent work in a sustainable, low-carbon world*; available at: http://www.ilo.org/wcmsp5/groups/public/@ed_emp/@emp_ent/documents/publication/wcms_158727.pdf

⁷ Eurostat (2009), *The environmental goods and services sector. A data collection handbook*, available at: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-09-012/EN/KS-RA-09-012-EN.PDF

definition for 'green jobs' but is the only source of harmonized European data providing information on employment related to activities with environmental purposes.⁸

The overall employment in the so-called "eco-industries" as defined by Eurostat is estimated at 1-2% of total European employment. Job creation in these industries has been positive throughout the recession in comparison to many other sectors, even if investments have dropped, and is forecast to continue to be quite sound in future years. Average annual growth in employment in the eco-industries in 2000-2008 was 2.7%. Total numbers employed have grown from 2.4 million in 2000 and 3.0 million in 2008 and are forecast to reach 3.4 million in 2012⁹.

At present, the size of the "eco-industries" sector in Europe is larger than the aerospace and defence sectors¹⁰. Estimates for countries such as United States and Germany indicate that 2-3% of total employment is related to activities to reduce CO2 emissions¹¹.

Available evidence on a sectoral level regarding the impact on employment shows that certain sectors are already experiencing strong employment dynamics, with solar, wind and biomass technologies progressing most rapidly¹². All in all, the renewables sector in Europe has seen an increase of more than 300,000 employees within only five years (2005-2009)¹³.

3. LABOUR MARKET CHALLENGES TO DEVELOPING A GREEN ECONOMY

Current available evidence in so called 'green jobs' and eco-industries appears to point to a bright future in terms of potential for employment creation in this area. Indeed, the sector has shown some impressive resilience and **positive growth in the face of the crisis**. Below an overview of the main drivers having an effect on job creation rates in the context of a greener economy is provided, as well as a qualitative assessment of job creation potential and labour market challenges and factors that can be expected as a result of this transformation.

3.1. Drivers influencing the rate of employment creation

Several factors will affect the employment creation potential associated with a transition to a new economic model based on a more efficient use of resources. These include particularly the **additional investments needed to reach the EU 2020 targets** (especially the Climate and Energy 20-20-20 targets for reducing greenhouse gas emissions, increasing the share of renewables and improving energy efficiency) and to pursue the 2050 vision in line with targets as set out in the 2050 Low-carbon and Energy Roadmaps¹⁴. For example, the

⁸ In addition the Commission pursues work and research to develop and produce measures other than GDP that better encompass environmental quality and sustainability. See: <http://www.beyond-gdp.eu/index.html>.

⁹ For all data linked to "eco-industries" see: Ecorys (forthcoming), *The number of jobs dependent on environmental and resource efficiency improvements*, Study for European Commission, Directorate General for Environment

¹⁰ See: http://ec.europa.eu/enterprise/policies/sustainable-business/eco-industries/index_en.htm

¹¹ EC/ILO (2011), *Towards a greener economy: the social dimensions*, p. 16, available at:

¹¹ <http://ec.europa.eu/social/main.jsp?catId=87&langId=en&moreDocuments=yes>

¹² The first two are developed for electricity generation while the latter is predominantly for the heating sector.

¹³ European Renewable Energy Council statistics available at: <http://www.erec.org/statistics.html>

¹⁴ COM (2011) 112 final, *A Roadmap for moving to a competitive low carbon economy in 2050*, available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0112:FIN:EN:PDF>; COM (2011) 885/2, *Energy Roadmap 2050*, available at:

¹⁴ http://ec.europa.eu/energy/energy2020/roadmap/doc/com_2011_8852_en.pdf

Renewable and the Energy performance of Buildings Directives were crucial for the development of renewables and energy efficiency market niches and led to new employment opportunities. The impact was coupled with a number of regulatory, financial and fiscal policies at Member States level. The process of job creation in energy efficiency will intensify with the implementation of more measures under the Ecodesign and Energy Labelling Directives and upon the adoption of a new Energy Efficiency Directive and more measures on financing.

Other important drivers will be higher **prices of energy goods**, needed to recover the cost of investments in the long run; and factor substitution between labour, capital and energy caused by higher carbon prices if emission permits are auctioned and/or by regulation that affects the allocation of production factors.

The employment impact can also be reinforced by the way in which **green-tax revenues are recycled** should market based instruments be used to reach the Europe 2020 targets. Recent studies show that the best employment outcomes will be yielded when revenues are used to subsidise low-carbon technologies, lower taxes and social security contributions paid by employers and/or employees, or raise or introduce in-work benefits that top up the wage income of most disadvantaged working households¹⁵. It should be noted that the average contribution of environmental taxes in the EU amounts to 6.3% of the overall tax bill. If all Member States were to raise this figure to 10% the result would yield an additional tax revenue equivalent to around 1.4% of EU GDP that could be used to reduce budget deficits or labour taxes¹⁶.

Studies show that the positive job creation impacts of green policies would outweigh the shortcomings. For example, the increased investments in energy efficiency would stimulate job creation in the construction and manufacturing of construction materials and sectors and would have limited impact on the reduction in jobs in the fossil fuels mining sectors.

3.2. Sectoral developments affecting job creation prospects

A recent study by the European Commission¹⁷ sought to analyse the sectors and occupations which might benefit from a transition to the low carbon economy in the coming decades. These are outlined in table 1.

¹⁵ Cambridge Econometrics et al, (2011), *Studies on sustainability issues – green jobs; trade and labour*; Final Report, Research Project for the European Commission, DG Employment, Social Affairs and Inclusion prepared by Cambridge Econometrics, GHK and the Warwick Institute for Employment Studies; Institute of Communication and Computer Systems of National Technical University of Athens, (2010), MODELS, Final Publishable Activity Report for Contract No: 044089 (SSPI). OECD (forthcoming), *The jobs potential of a shift towards a low-carbon economy*, study prepared for the European Commission, DG Employment, Social Affairs and Inclusion, p.90. OECD analysis did not include recycling of revenues towards R&D and low-carbon technologies.

¹⁶ Ecorys (2011), *The role of market-based instruments in achieving a resource efficient economy*;

¹⁷ Cambridge Econometrics et al, (2011), *op.cit.*

Table 1. Sectors and occupations with potential to benefit from the low-carbon transition

OCCUPATIONS WITH POTENTIAL TO BENEFIT FROM THE LOW-CARBON TRANSITION, BY SECTOR						
	R&D	Manufacture & installation/ engineering	Operation & maintenance	Management	Administration	Sales
Renewable energy	✓	✓	✓	✓	✓	✓
Conventional power generation			✓	✓	✓	
Cement		✓				
CCS	✓	✓	✓			✓
Iron & steel	✓		✓	✓		
Machinery & electrical equipment	✓	✓		✓		
Construction	✓	✓		✓	✓	✓
Transportation			✓	✓	✓	

Source: Cambridge Econometrics et al, (2011)

Several studies show the potential employment gains at EU level in a more disaggregated manner. They illustrate types of employment critical for achieving green growth. However, these estimates are not cumulative as they are based on various modelling exercises performed under different scenarios and, are subject to some forecasting uncertainty. Some selected results from recently conducted studies are outlined below.¹⁸

In the coming years, advancement and implementation of **climate adaptation measures** will spur demand for both high- and low-skilled labour. Construction will be one of the sectors directly benefiting from this as major investments in adaptation could offer employment and income opportunities in activities such as extending coastal defences, reinforcing buildings and infrastructures, water management and relocation of exposed settlements¹⁹. Other activities will also gain, such as the development and manufacture of advanced water management technologies; development, distribution, and cultivation of drought-resistant

¹⁸ For a more detailed overview of studies see: Cambridge Econometrics et al, (2011), *op.cit.*, available at: <http://ec.europa.eu/social/keyDocuments.jsp?policyArea=&type=0&country=0&year=0&advSearchKey=tacklingclimatechange&mode=advancedSubmit&langId=en>

¹⁹ UNEP/ILO (2008), *Green jobs. Towards decent work in a sustainable, low carbon world*, available at: http://www.ilo.org/wcmsp5/groups/public/@ed_emp/@emp_ent/documents/publication/wcms_158727.pdf. Also according to an on-going study commissioned by DG MARE, "Blue Growth: scenarios and drivers for sustainable growth from the oceans, seas and coasts", (ECORYS) both coastal protection and the marine and maritime monitoring and surveillance sectors are set to grow both in terms of turnover and employment.

seeds; development of ecosystem based adaptation measures; integrated modelling and climate risk assessment; or development of early warning systems.²⁰

Climate adaptation measures will also decrease disruptions on economic activity and workforce availability due to climate change related natural phenomena (e.g. floods, heat waves, changes in precipitation patterns). The forthcoming EU Adaptation Strategy will provide additional evidence on the employment implications of adaptation to climate change.

In terms of **resource efficiency**, a number of tested policy simulations demonstrate that the EU could realistically reduce the total material requirements of its economy by 17%. It could then boost the GDP by up to 3.3% and create between 1,4 and 2,8 million jobs. Every percentage point reduction in resource use could therefore lead to up to 100,000 to 200,000 new jobs²¹.

The implementation of individual **energy efficiency** measures could lead to 2 million green jobs being created or retained by 2020²². These are jobs mainly for the renovation of the building stock, the uptake of products covered by eco-design and labelling measures (e.g. electric motors and drivers, refrigerators and freezers, circulators), and the improvement of energy efficiency in the manufacturing sector. A large part of these jobs would be in the construction sector – linked to a move from new construction to renovation of existing buildings – therefore having a direct positive impact on one of the sectors worst affected by the economic crisis. Taking into account the scope of the challenge to renovate Europe's buildings stock this could be a long-term engagement, lasting for at least 30 years, mainly for local SMEs.

Job potential from **renewable energy (RE)** sector development is estimated at 3 million jobs by 2020²³. Also, implementation of the revised **Energy Taxation Directive** could create 1 million jobs by 2030²⁴ in cumulative terms. These might be associated equally with high-, medium-, as low-skilled positions in: equipment manufacturing and distribution, project development, construction and installation, operation and maintenance. A closer look at the types of employment created in the renewable energy field reveals that the policy approach matters. More ambitious RES policy targets trigger investments and hence employment in knowledge intensive generation technologies while a less ambitious policy target provides an impulse for employment via biofuels. Capital-intensive technologies such as photovoltaic and wind off- and on-shore, solar thermal and heat pumps dominate in absolute terms under a strong RES promoting policy. For many of these technologies, the construction phase is the most labour intensive one. However, this is not the case for biomass-based renewable energy use.

²⁰ See for instance: Oxfam America (2010), *A fresh look at the green economy. Jobs that build resilience to climate change*, available at: <http://www.oxfamamerica.org/files/a-fresh-look-at-the-green-economy.pdf>

²¹ GWS (2011), *Macroeconomic modelling of sustainable development and the links between the economy and the environment*, Report for the European Commission, DG Environment prepared by Cambridge Econometrics, the Institute of Economic Structures Research (GWS), the Sustainable Europe Research Institute (SERI) and the Wuppertal Institute for Climate, Environment and Energy (WI); available at: http://ec.europa.eu/environment/enveco/studies_modelling/pdf/report_macroeconomic.pdf

²² COM (2011) 109 final, *Energy Efficiency Plan 2011*, available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0109:FIN:EN:PDF>

²³ COM (2011) 31 final, *Renewable Energy: progressing towards the 2020 target*, available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0031:FIN:EN:PDF>

²⁴ COM (2011) 168/3, *Smarter energy taxation for the EU: proposal for a revision of the Energy Taxation Directive*, available at: http://ec.europa.eu/taxation_customs/taxation/excise_duties/energy_products/legislation/index_en.htm

Raising revenue through **carbon pricing**, such as through auctioning of allowances via the Emissions Trading System (ETS) or taxing CO₂ in other non-ETS sectors and lowering taxation on labour can have positive effects for employment. Full recycling of revenues to reduce the costs of labour potentially could increase employment in the EU by 0.7% or up to 1.5 million jobs by 2020²⁵.

Moving away from a wasteful economy towards one based on durability and reparability of products is likely to create job opportunities throughout the product lifecycle in terms of, maintenance, repair, upgrade, and reuse. Full implementation of the EU **waste acquis** would increase the annual turnover of the EU waste management and recycling sector and create over 400 000 jobs by 2020. Some research shows also, that by **recycling** 70% of key materials the EU could create over 560 000 new jobs by 2025²⁶.

Achieving the objectives of the **EU 2020 Biodiversity Strategy**²⁷ is expected to have a positive impact on jobs and to create a need for special skills. **Conserving, managing and restoring the natural environment** will push up demand for workers in sustainable agriculture and forestry, eco-tourism, sustainable fisheries, the marine environment, environmental monitoring, nature conservation, forestry, use of genetic resources (pharmaceutical, cosmetic), spatial planning for green infrastructures, and more resource efficient methods of managing maritime space²⁸. These niche opportunities also offer good prospects for the development of social economy activities and reinsertion of vulnerable workers. The numbers of jobs provided directly and indirectly by biodiversity and ecosystem services is significant – in the EU they are projected at 14.6 million of people²⁹.

3.3. Managing labour shortages and skills transformation

As stated in the Commission flagship initiative ‘*An agenda for new skills and jobs: A European contribution towards full employment*’³⁰, Europe has to be able to rely on a skilled workforce, capable of contributing and adjusting to technological change with new patterns of work organisation.

The gradual shift towards a new economic model will lead to a **progressive redefinition of many jobs across almost all sectors**. New skills will be demanded of employees in order to satisfy business growth needs and meet changes in job profiles and content. A more low carbon and resource efficient economy is likely to create demand for both transversal competences and "specific" skill sets³¹. Transversal competences are gaining in importance since a lot of green projects are done within multidisciplinary teams bringing together professionals with different backgrounds. In this context, certain skill sets are essential in order to ensure successful outcomes, among these: strategic planning, leadership and

²⁵ SEC(2011) 288 final, *Impact assessment. Accompanying document to the Roadmap for moving to a competitive low carbon economy in 2050*, p. 90; available at:

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011SC0288:EN:NOT>

²⁶ Friends of Earth (2010), *More jobs, less waste – potential for job creation thorough higher rates of recycling in the UK and EU*, available at: http://www.foe.co.uk/resource/reports/jobs_recycling.pdf

²⁷ COM (2011) 244 final, *Our life insurance, our natural capital: an EU biodiversity strategy to 2020*, available at:

[http://ec.europa.eu/environment/nature/biodiversity/comm2006/pdf/2020/1_EN_ACT_part1_v7\[1\].pdf](http://ec.europa.eu/environment/nature/biodiversity/comm2006/pdf/2020/1_EN_ACT_part1_v7[1].pdf)

²⁸ http://ec.europa.eu/maritimeaffairs/policy/maritime_spatial_planning/index_en.htm

²⁹ GHK (2011), *The Social Dimension of Biodiversity Policy*; available at:

<http://ec.europa.eu/environment/enveco/biodiversity/pdf/Social%20Dimension%20of%20Biodiversity.pdf>

³⁰ COM (2010) 682 final, *op.cit.*

³¹ CEDEFOP (2009), *Green economy*, Skillsnet Sector Flash, June, available at:

[http://www.cedefop.europa.eu/etv/Upload/Projects_Networks/Skillsnet/Flashes/SkillsnetSF_GreenEco\(HR\).pdf](http://www.cedefop.europa.eu/etv/Upload/Projects_Networks/Skillsnet/Flashes/SkillsnetSF_GreenEco(HR).pdf)

management skills, communication in order to advise users about new technologies, adaptability/transferability skills, systems analysis, risk analysis, coordination, etc.

The "specific" skills associated with the green economy are not entirely new skills³². They are add-on or a mixture of existing skills such as knowledge of sustainable materials, relevant traditional skills for installation of new technologies (e.g. fitting or electrical skills for installation of solar tube or panel technologies), skills to measure the carbon footprint and environmental impact assessment skills (e.g. energy assessment, diagnostic skills).

In an initial phase, **high-skilled** workers may benefit more as the transition to new activities calls for the roll out of advanced technologies³³. Indeed, many of these sectors are characterised by intense innovation implying that generic skill requirements might be somehow higher overall than for similar occupations in other parts of the economy. With market deployment of new technologies, **lower-skilled** workers will also benefit from diversifying and enhancing their skills to adjust their current job content or to fill new positions. This is currently the case in the area of building renovation where in addition to planners (e.g. architects, designers, engineers and auditors), lower-skilled workers are needed to carry out the actual work. As for the **medium skilled workers**, the challenge will be to ensure that their skills are up-to-date and to prevent them from falling down the skills ladder as a result of inadequate adaptation and access to training possibilities.

Ensuring that workers have the right skills will be a challenging task as it will require **mapping employers' fast evolving needs** in a nascent field and delivering adequate and increasingly demanded tailored training. This will be essential in avoiding a 'muddle through' approach where insufficient planning is done by enterprises, especially SMEs, and employees receive inappropriate re-skilling and the possibility of recruiting new competent staff is disregarded³⁴. Multiple entry routes, **varied levels of qualification and insufficient recognition** of skills acquired through non-formal or informal learning **could limit mobility** of workers into green occupations. Moreover, a lack of qualified **professional coaches/trainers** enabling the delivery of new skills to workers could well slow down the process of equipping the workforce with the skills sought by employers.

Certain sectors already face skill shortages and European companies are lacking the qualified labour needed for working with emerging low-carbon technologies. For instance, in Germany the renewables industry has pointed to a lack of qualified workers, including technical engineers, while companies in Britain are facing a shortage of supply of technical specialists, designers, engineers and electricians in sectors going green (Ecorys, 2008). An acute shortage of engineers was reported also by wind energy companies in other EU countries³⁵.

The more environmentally friendly modes of transport are also vulnerable to skill shortages in part related to deep demographic trends but also to more immediate causes such as changes in

³² Szovics, P., M. Tessaring, Cl. Walmsley and J. McGrath (2008), *Identification of future skill needs for the green economy*, Conclusions from the workshop on Future skill needs for the green economy, October, available at: http://www.cedefop.europa.eu/etv/Upload/Projects_Networks/Skillsnet/Flashes/GreenEco-conclusions.pdf; and GHK (2009), *Thematic Expert Work on Green Jobs for DG EMPL/D1*, unpublished report submitted by GHK for DG Employment, European Commission.

³³ In this respect, figures show that three quarters of high-skilled workers in the EU-15 are employed in low-carbon intensive sectors.

³⁴ CEDEFOP (forthcoming), *Green Skills and Environmental Awareness in Vocational Education and Training*

³⁵ Blanco, M. and G. Rodrigues (2009), *Direct employment in the wind energy sector: An EU study*, Energy Policy, Vol. 37, No 8, pp. 2847-2857.

the organisation of markets or the economic crisis itself which has slowed down the hiring and training of new workers. In the railway sector for example, the average age of workers is rising constantly and skill renewal is thus a major challenge.³⁶ A lack of skilled personnel is also a problem for sea and inland navigation and may soon harm the different forms of collective public transport as well as the greening of transport and logistics in general. As for the maritime economy the potential for green jobs is not fully perceived due to the **lack of visibility**. This creates a barrier to growth, despite the fact that qualifications required in the maritime context are often similar to those required in land-based sectors. As a consequence, these sectors are also suffering from a shortage of workers.

A fundamental weakness in the EU's skills base is the deficit in management skills and technical, job-specific skills, especially related to **science, technology, engineering and mathematics (STEM)**. This might weigh even more heavily on the EU's capacity for green growth than shortages in specialist clean-tech know-how³⁷. At the same time, research and innovation are critical to make new, more efficient and cost-effective low-carbon energy technologies commercially attractive at the scale needed to deliver a sustainable energy system by the middle of the century, to regain a European industrial leadership on low carbon technologies as prioritised within the Strategic Energy Technology (SET-) Plan³⁸, and to achieve the European Commission's 2050 Low-carbon and Energy Roadmaps vision³⁹.

Whilst companies may take it upon themselves to revamp employees' skills, the role of **Public Employment Services (PES)** is key in preparing jobseekers to benefit from new job openings by ensuring quick labour market transitions and successful matching practices. A pro-active approach by PES is needed to provide comprehensive services such as counselling, advice, training and general re-skilling initiatives with a particular effort made to ensure participation of the most vulnerable. Ensuring that **Active labour market policies** provide return on investment in employment terms and that they are targeted and designed to meet labour demand needs, will be of critical importance so that they can lead to a real work experience and/or placement.

On the side of employers, special attention should be paid to **SMEs** and their needs, as they could especially benefit from external support in upgrading the skills of their workforce in the transition to a greener economy. Often, SMEs are not aware of training schemes offered by PES and/or are sceptical about such programs because of the disruption it may cause to their business. However, SMEs are open to in-house informal training (e.g. tutorship, mentorship, apprenticeship) as a preferential way of recruiting proven workers.

The importance of human capital investments in enabling the transition to a low-carbon and more resource efficient economy is well-recognised in the Commission's proposal⁴⁰ for the **European Social Fund 2014-2020**. ESF resources can be used by national, regional and local authorities for example to strengthen provision of relevant skills through their education and

³⁶ CER Annual report 2009-2010, pp 28-29, available at: <http://www.cer.be/publications/annual-reports/2011-annual-report-2009-2010-a-closer-look-at-the-railways>

³⁷ Cedefop (2010), *Skills for green jobs*, European Synthesis Report, available at: http://www.cedefop.europa.eu/EN/Files/3057_en.pdf

³⁸ COM (2007) 723 final, *A European Strategic Energy Technology Plan (SET-Plan). Towards a low carbon future*, available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0723:FIN:EN:PDF>; and COM (2009) 519 final, *Investing in the Development of Low Carbon Technologies (SET-Plan)*, available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0519:FIN:EN:PDF>

³⁹ COM (2011) 885/2, *op. cit.*

⁴⁰ COM (2011) 607 final, *Proposal for a Regulation of the European Parliament and of the Council on the European Social Fund and repealing Regulation (EC) No 1081/2006*, available at: <http://ec.europa.eu/esf/BlobServlet?docId=231&langId=en>.

training systems, support the adaptation of workers and enterprises or improve the capacity of PES to assist in green transitions.

It should be noted that the shift to a low carbon economy is expected to have very diverse effects in terms of the overall levels of skills required, but also in terms of **how novel these skills are** compared to familiar occupational requirements for which training is already established⁴¹ – this is demonstrated by various examples of greening of occupations as depicted in Table 2.

Table 2. The skill profile of low carbon occupations: selected illustrative examples

Occupations	Growth profile	Skill profile	Policy challenges and national initiatives
Recycling & Waste management (continued development of long-established sector)			
Waste sorting and reception	Long-established occupation	Low qualification (minimal on-the-job training)	Low job quality and health risks are main concerns, not skill deficits
Hazardous waste management specialist	Growing demand expected in medium and long run due to tighter regulations	Medium and high level	Identified shortage of qualified workers e.g. in Spain in the medium term
Transportation (increase energy efficiency and/or reduce the environmental impact of various modes of transportation)			
Specialized technicians of fuel cell batteries, automotive maintenance technicians	Introduction of renewable and cleaner fuels for transportation	Low to medium level for installation and maintenance	Uncertainty about which fuels for transportation will eventually mainstream
Automotive engineers, freight forwarders, fuel cell engineers, logistics analysts, logistics engineers, logistics managers, supply chain managers, transportation engineers and transportation planners	Reorganisation and the re-engineering of the transportation systems	Medium and high level skills, combined with sector-specific, pre-existing medium and high-level competencies	Best candidates could be incumbent employees with retraining to get needed skill mix, but with a substantial retraining process for some occupations and a role for new professional development tracks in tertiary education
Vehicle manufacturing (energy-efficiency, waste and product lifecycle management, shift of business model from products to services)			
Engineering technicians, welders, transportation equipment painters, metal fabricators, computer-controlled machine operators, engine assemblers, and production helpers	Greening production techniques for vehicles components	Low to medium general skills with medium job-specific skills	Close integration of industry and education. For example, in the UK North East's Low Carbon Economic Area (LCEA), the National Training Centre for Sustainable Manufacturing was created
Computer software engineers, electrical engineers and operations managers	Changes in production methods and business models	Medium and high	E.g. the Low Carbon Future Leaders Graduate Placement Scheme in the UK
Mining and extractive industry (shrinking the environmental footprint)			
Operators of heat coproduction, Geospatial Information Technologists	Upgrading core technologies	Medium	E.g. Eesti Energia's training programmes for current and new employees
Geospatial Information	Supply chain re-	High level for	Estonia, for example, revised

⁴¹ OECD (forthcoming), *op. cit.*

Occupations	Growth profile	Skill profile	Policy challenges and national initiatives
Scientists and Technologists, managers for heat coproduction, energy auditing, and technology developers and managers	organization, and upgrading management practices	development of new technologies and production re-organization	and coordinated higher-education programmes in mining

Source: OECD (*forthcoming*)

Finally, shifts both within and across sectors require support for those with low and obsolete skills, so as to prevent the risk of structural unemployment and inactivity prospects.

In declining sectors some skills/occupations are already becoming obsolete. For instance, utility meter reading services will be phased out by the introduction of ‘smart’ household meters that automatically relay data to utility companies. **The skills composition of workers in high- and low-carbon intensive sectors will influence the employment transition to a greener economy.** Evidence shows that in all but two countries, the share of low-skilled labour in high-carbon sectors is higher⁴² than in low carbon sectors. Moving workers from high to low carbon intensive sectors will thus require additional re-skilling strategies.

This transition process might impact on particular regions, urban/rural development and workers' mobility. Employment in areas with a high concentration of either traditional energy-intensive and high-carbon industries or by poor economic diversification risk being hit during the transition process and development of integrated strategies for economic revitalisation of such areas is therefore an important element of the transition process. The fisheries sector offers a good example as changes to fisheries policy and the scaling down of the fishing fleet has put many workers at risk of redundancy. This requires accompanying targeted measures that prevent this particular group from falling into long-term unemployment or inactivity. Growing sectors may offer opportunities to use skills acquired from workers employed in declining sectors. This is notably the case for some coastal and maritime activities. Synergies between such sectors could be developed hence facilitating the sectoral mobility of workers.

However, and contrary to other transitions (e.g. globalisation, ICT), short to medium term costs linked to firm restructuring in the context of a green economy might not be fully compensated by productivity improvements and companies could be searching for additional compensation through cheaper labour. A potential risk exists that the low pay trap or unemployment **will affect in particular older and low-skilled workers** over-represented in the most polluting industries⁴³. Investments in innovation and re-skilling are crucial for counteracting this threat.

Much of the adjustment in the high-carbon sector is expected to occur in only 15 industries⁴⁴ occupying up to 12% of EU workers (or some 24 million people). At the same time, the gap between EU-15 and EU-10 is particularly striking – more than 20% of all employees in the

⁴² EC/ILO (2011), *Towards...*, *op.cit.*, p. 52

⁴³ OECD (*forthcoming*), *op.cit.*

⁴⁴ These include following industries: electrical energy, gas, steam and hot water; coal and lignite, peat; products of agriculture, hunting and related services; other non-metallic mineral products; crude petroleum and natural gas; basic metals; sewage and refuse disposal services; glass and glass products; coke, refined petroleum products, nuclear fuel; other land transportation services; articles of paper and paper board; manufactured gas and distribution services of gas; pharmaceuticals, medicinal chemicals, botanical prod.; chemicals, chemical products, manmade fibres; air transport services.

EU-10 are working in the top 15 emitting industries, which is more than double the rate in EU-15 countries⁴⁵.

3.4. Securing sufficient levels of investment

If the transition to a resource efficient and low carbon economy is to succeed, **smart investment plans will be needed to capitalise on emerging opportunities and tap into the job creation potential** in this area. Recent developments show that as many other segments of the economy, the clean technologies area is also vulnerable to the impacts of the economic and financial crisis, as well as to the increasing competition from emerging economies such as China and India.⁴⁶ Indeed, according to the International Energy Agency (IEA), investments in renewable energies dropped by 14% in Europe during the second semester of 2008 alone, and they decreased further in 2009 by 10%, while increasing by more than 50% in China. The February 2012 Renewable Energy Country Attractiveness Indices cites China as the most attractive location in which to invest in renewable energy projects, followed by the US⁴⁷.

Strategic medium to long term policy planning in this field will require that **governments create conditions for substantial investments** in low carbon and resource efficient industries, while ensuring compliance with the EU State aid rules, in an attempt to prepare the ground for tomorrow's economic model. For instance, the main driver of the employment effects in the promotion of the renewable energy sector are the considerable investments required to upgrade the energy infrastructure.

Analysis undertaken by the Commission suggests that whilst annual capital investment in renewable energy today averages € 35 bn, this would need to rapidly double to € 70 bn to ensure we achieve our renewables goals. Previous analysis showed that, from a base of 1.4 million people across the EU, i.e. 0.7% of the total EU workforce, the renewable energy sector would generate roughly 2.3 million jobs in 2020 under business as usual, and 2.8 million jobs under ambitious policies consistent with the 2020 targets (growing up to 3.4 million in 2030)⁴⁸.

The analysis on the 2050 Low-carbon Roadmap shows that to prepare the transition to a low-carbon economy, over the next 40 years additional annual investment equivalent to 1.5% of EU's GDP, or around € 270 billion, would be needed on top of current annual investment equivalent to 19% of GDP in 2009. It is not a net cost for the economy or a reduction of GDP, but an additional investment in our own economy that would bring multiple benefits such as reduced energy bill, less health care costs and damage to ecosystems, crops, materials and buildings.

Joint public-private ventures can use public finances, while ensuring compliance with the EU State aid rules, and regulatory policy to support the scaling up of private investment in energy efficiency. As identified by the International Energy Agency (IEA)⁴⁹ three main mechanisms are needed to put in place such initiatives i) dedicated credit lines ii) risk guarantees and iii) energy performance service contracts. Equally important factors in making

⁴⁵ EC/ILO (2011), *op.cit.*, p.17

⁴⁶ E.g. European Restructuring Monitor reported that Danish turbine maker Vestas, a world-leader in the field, announced it would have to cut more than 2,300 jobs – 10% of its workforce – to restore profitability as it faces firm competition from China. And in Spain approximately 15 000-25 000 jobs were lost because of austerity measures and withdrawal of the feed-in tariffs to solar energy contributed to the bankruptcy of a number of newly created establishments.

⁴⁷ Ernst&Young (2012), *Renewable Energy Country Attractiveness Indices*, available at: <http://www.ey.com/GL/en/Industries/Power---Utilities/Renewable-energy-country-attractiveness-indices>

⁴⁸ See: http://ec.europa.eu/energy/renewables/studies/renewables_en.htm

⁴⁹ See: http://www.iea.org/publications/free_new_Desc.asp?PUBS_ID=2489

such initiatives a success are careful **planning**, diligent **implementation**, **continuous monitoring** of measures and regular **evaluation** of results.

Ensuring that **SMEs fully benefit** from the transition to a low carbon economy in terms of improved competitiveness, growth and market coverage is also of utmost importance. A strong SME sector is fundamental for a healthy economy. Indeed, studies show that⁵⁰ about two thirds of the jobs created in the renewables sector are based on SMEs. Policies must therefore take into account the specificities and needs of this particular group of companies. For instance, transition to a greener economy will require adaptation of workforce skills in order to ensure the necessary supply of high-skilled or intermediary-skilled workers. Normally SMEs are at a disadvantage when recruiting such workers, as SMEs cannot match the wages and non-financial arrangements offered by larger companies. Also, it has to be noted that SMEs have more difficulties to train their workforce in-house as compared to larger companies.

3.5. Job quality

'Green jobs' will only be sustainable if they also integrate safe, healthy and decent working conditions. They should not only be good for the environment but also for workers. As the Community Strategy 2007-2012 on Health and Safety at Work acknowledges, occupational safety and health plays a vital role in increasing the competitiveness and productivity of enterprises and contributing to the sustainability of the economy.

The greening of the economy stimulates the demand for high, medium and low skilled jobs. Increased demand for high-skilled labour is likely to have an overall positive impact on **job quality** as in general, the higher the level of skill (or qualification) associated with an occupation, the higher the job quality. It is however also to be expected that there are occupations, which are currently associated with relatively high quality employment, which may contract, i.e high quality jobs amongst office clerks in high-carbon industries and skilled agricultural and fishery workers while job quality in newly arising 'green' economic activities is generally satisfactory.

Adjustments in the transition to a more low carbon and resource-efficient economy may equally create challenges in terms of improving the gender balance on the labour market in terms of both quality and quantity of green jobs. Apart from the total and sectoral employment effects it is to be noted that **women** and **young** people are currently more likely to be employed in non-green occupations compared to other workers. Some sectors (as for instance, the maritime economy) suffer from a **lack of attractiveness** and difficulties in appealing to young people into what is perceived to be 'dirty' manual work. The job potential in sectors suffering from the image problems therefore remains underexploited as many typically male-dominated jobs are sometimes wrongly seen as having unattractive work conditions with low pay⁵¹. Here again, the increased skills requirements associated with the need for greater efficiency in using natural resources may improve job quality and perception.

Where jobs are created in companies and sectors with little tradition of **social dialogue** and employee representation, safeguarding the fundamental rights of workers⁵², ensuring equal pay and decency of work can present particular challenges. Changes in working conditions

⁵⁰ EC/ILO (2011), *Skills...*, *op.cit.*

⁵¹ CEDEFOP (forthcoming), *op.cit.*

⁵² Such as: freedom of assembly, workers' rights to consultation within the undertaking, right of collective bargaining and action. Also a requirement of adequate representation of women in the collective structure is a way to ensure that social partners work towards new jobs that provide quality work for both women and men.

and their impact on workers will have to be accounted for while social security coverage of workers as well as the portability of social rights of mobile workers are also issues to be addressed. 'Green' construction, building insulation activities and consumer waste disposal are examples of sectors experiencing employment growth and meriting further investigation of possible problematic areas in terms of job quality, such as precarious forms of employment or health and safety issues⁵³. Risks can include manual handling during collection and sorting of waste management and potential exposure to hazardous chemicals.

Indeed, examples exist of 'green jobs' where workers' health was damaged (e.g. in the waste management sector)⁵⁴. Also, jobs where traditional skills are needed but in new contexts (e.g. installation of solar panels) attract workers from traditional sectors who may not have the appropriate skills to perform these new jobs in a safe and healthy manner (e.g. electricians not trained for working at height, or construction workers not trained against electrical hazards). This shows the importance of ensuring that workers have the adequate prevention culture and occupational safety and health skills to perform green jobs.

⁵³ For more information see: WALQING (Work and Life Quality in New & Growing Jobs) project financed under the 7th Framework Programme, available at: <http://www.walqing.eu/>

⁵⁴ EU-OSHA (forthcoming), *Foresight of new and emerging risks to occupational safety and health associated with new technologies in green jobs by 2020*. This foresight project has 3 phases. Phase 1 report on key drivers of change, available at: <http://osha.europa.eu/en/publications/reports/foresight-green-jobs-drivers-change-TERO11001ENN/view>. Phase 2 report on key new technologies, available at: <http://osha.europa.eu/en/publications/reports/foresight-green-jobs-key-technologies>
EU-OSHA (2009), *Expert forecast of emerging chemical risks related to occupational safety and health*, available at: http://osha.europa.eu/en/publications/reports/TE3008390ENC_chemical_risks
EU-OSHA (2007), *Expert forecast of emerging biological risks related to occupational safety and health*, available at: <http://osha.europa.eu/en/publications/reports/7606488>