

**FORESIGHT OF NEW AND EMERGING RISKS TO  
OCCUPATIONAL SAFETY AND HEALTH ASSOCIATED  
WITH NEW TECHNOLOGIES IN GREEN JOBS BY 2020**

**PHASE 1 - DELIVERABLE D1  
CONTEXTUAL DRIVERS OF CHANGE  
LITERATURE REVIEW**

Authors – Peter Ellwood, Sam Bradbrook, John Reynolds and Martin Duckworth

Date – April 2010

## Table of contents

Table of contents .....	2
List of tables.....	2
1. Introduction .....	3
2. Background.....	3
3. Project Structure .....	3
4. Scope of the Project .....	3
4.1. New and emerging risks .....	3
4.2. Green jobs .....	4
5. Contextual Drivers of Change.....	5
5.1. Literature Review Methodology .....	5
5.2. Global studies .....	6
5.3. European studies .....	7
5.4. National studies .....	8
5.5. Hierarchy of drivers.....	8
6. References.....	9
7. Annexes .....	11
7.1. Annex 1: Literature Sources for Drivers of Green Jobs and Potential Health and Safety Risks of Green Jobs.....	11
7.2. Annex 2: Drivers for Green Jobs and Potential Health and Safety Risks in Green Jobs .....	18

## List of tables

Table 1: Green recovery in the US .....	5
Table 2: Shades of green: pro-environmental measures in major segments of the economy.....	7

## 1. Introduction

This report is the first formal deliverable from the project 'Foresight of New and Emerging Risks to Occupational Safety and Health Associated with New Technologies in Green Jobs by 2020' commissioned by the European Risk Observatory (ERO). It is intended to provide a brief summary of the literature on contextual drivers for new health and safety risks arising from new technologies in green jobs to 2020, and a list of such drivers in order to inform the next stage of the project – a consultation to produce a consolidated list of drivers for use in scenario-building.

## 2. Background

The overall aim of the project is to produce sets of scenarios for 2020, covering a range of new technologies in green jobs, in order to inform EU decision makers, Member States' governments, trade unions and employers, so that they can take decisions in order to shape the future of occupational safety and health in green jobs towards safer and healthier workplaces.

The decision to pursue a scenario-building project arose out of a workshop hosted by the ERO in October 2008. The ERO wished to build on earlier foresight exercises comprising Delphi studies in four different risk areas, which had produced useful summaries and prioritisation of key risks as assessed by experts. However, it was felt that in order to consider likely health and safety risks further into the future, an alternative technique should be used. The scenario building approach was selected as a suitable vehicle to providing a forward look. In order to limit the scope to manageable proportions, new technologies in green jobs were selected as the target area. The rationale behind this choice is twofold. New technologies is an area where we are most likely to be confronted with new risks and the Community strategy on health and safety at work 2007-2012 emphasises 'risks associated with new technologies' as an area where risk anticipation should be enhanced. [1] In addition, the impetus to 'green' the economy, associated with a strong emphasis on innovation in this sector, is the opportunity to anticipate potential new risks in these developing green jobs and make sure their design integrates workers' safety and health.

## 3. Project Structure

The project will be carried out in three distinct phases:

- **Phase 1** will involve the identification of key contextual drivers of change that could contribute to creating new and emerging risks associated with new technologies in green jobs by 2020. The drivers identified will be used in the generation of a basic set of scenarios from which the final scenarios will be derived.
- **Phase 2** is the identification of the key technological innovations that may be introduced in green jobs over the next ten years that may lead to new and emerging risks in the workplace or have a positive impact on workers' safety and health.
- **Phase 3** will comprise a series of workshops to be held across Europe to generate the scenarios, based on the findings of Phases 1 and 2.

## 4. Scope of the Project

It is important at the outset to clarify the definitions of the terms 'new and emerging risks', 'new technologies' and 'green jobs' and the interpretations of those definitions appropriate to this project.

### 4.1. *New and emerging risks*

EU-OSHA defines new and emerging risks as follows:

'An "emerging OSH risk" is any occupational risk that is both "new" **and** "increasing".

By "new" we mean that:

- the risk did not previously exist and is caused by new processes, new technologies, new types of workplace, or social or organisational change; **or**,
- a long-standing issue is newly considered as a risk due to a change in social or public perceptions; **or**,
- new scientific knowledge allows a long-standing issue to be identified as a risk.

The risk is "increasing" if the:

- number of hazards leading to the risk is growing, **or** the
- likelihood of exposure to the hazard leading to the risk is increasing, (exposure level and/or the number of people exposed), **or** the
- effect of the hazard on workers' health is getting worse (seriousness of health effects and/or the number of people affected).'

## 4.2. **Green jobs**

There are many definitions of 'green jobs'. Green jobs used to be considered as those involved with protecting biodiversity and the natural environment, but they now include areas such as low-carbon jobs, energy efficiency, and carbon finance. They can also go beyond 'direct' green employment into the supply chain, even though they may not supply green industries. Nuclear may be green to some, in the context of its low-carbon credentials, but not to others. [2] Some commentators distinguish 'green jobs', which contribute to improving or preserving the environment, from 'green collar jobs', which are green jobs that are also 'decent' jobs in that they are good for the worker as well as the environment. Others talk about 'greening the workplace'. The US Blue Green Alliance describes a green job as 'a blue-collar job with a green purpose'. [3] Although this is the view of a particular group, when we come to consider our remit of new and emerging risks in green jobs, the blue-collar label might not be too far adrift.

Pollin et al, [4] break green jobs into three categories:

- Direct Jobs: first round of job changes resulting from changing outputs in target industries.
- Indirect Jobs: subsequent job changes resulting from changing inputs required to accommodate the above.
- Income induced jobs: additional jobs created by changes in household incomes and expenditures resulting from both above.

Different definitions or interpretations of them will suit the purposes of those using the terms. Politicians, for example, will be eager to take a broad approach to the definition in order to boost the numbers of those apparently in green jobs. In the OSH arena, we will want to be more critical in our definition, focusing on potential risk rather than inflating numbers.

An often-quoted definition of green jobs is that used by the United Nations Environment Programme. [5]

'We define green jobs as work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; de-carbonise the economy; and minimize or altogether avoid generation of all forms of waste and pollution.'

This definition usefully describes the areas or work potentially covered by the green label, but in terms of jobs, including as it does administrative jobs, it gives a huge scope to green jobs. Pollin et al, [4] give a list of typical jobs that might be associated with various green activity areas in Table 1.

At the kick-off meeting for this project the European Risk Observatory clarified its requirements and interpretation of the above definitions in the context of this project. It advised that the aim was to investigate *new types* of risk related to *new technologies* within green jobs. So the primary interest is in those *working with* or *directly* affected by the new technologies, rather than those merely associated indirectly with the new technologies. 'White collar' jobs in a green industry are not of interest. *New combinations* of risk are of interest, for example installation of solar panels, where electrical risks combine with the risk of working at height. Jobs in green industries where the risks are the same as other jobs, for example transport of green goods, are not of interest. *Novelty* is of more interest than the increase or decrease of known risks. The focusing of attention in this way makes the task more manageable and potentially more useful.

**Table 1: Green recovery in the US**

<b>Strategies for Green Economic Investment</b>	<b>Representative Jobs</b>
<b>Building Retrofitting</b>	Electricians, Heating/Air Conditioning Installers, Carpenters, Construction Equipment Operators, Roofers, Insulation Workers, Carpenter Helpers, Industrial Truck Drivers, Construction Managers, Building Inspectors
<b>Mass Transit/Freight Rail</b>	Civil Engineers, Rail Track Layers, Electricians, Welders, Metal Fabricators, Engine Assemblers, Bus Drivers, Dispatchers, Locomotive Engineers, Railroad Conductors
<b>Smart Grid</b>	Computer Software Engineers, Electrical Engineers, Electrical Equipment Assemblers, Electrical Equipment Technicians, Machinists, Team Assemblers, Construction Labourers, Operating Engineers, Electrical Power Line Installers and Repairers
<b>Wind Power</b>	Environmental Engineers, Iron and Steel Workers, Millwrights, Sheet Metal Workers, Machinists, Electrical Equipment Assemblers, Construction Equipment Operators, Installation Helpers, Labourers, Construction Managers
<b>Solar Power</b>	Electrical Engineers, Electricians, Industrial Machinery Mechanics, Welders, Metal Fabricators, Electrical Equipment Assemblers, Construction Equipment Operators, Installation Helpers, Labourers, Construction Managers
<b>Advanced Biofuels</b>	Chemical Engineers, Chemists, Chemical Equipment Operators, Chemical Technicians, Mixing and Blending Machine Operators, Agricultural Workers, Industrial Truck Drivers, Farm Product Purchasers, Agricultural and Forestry Supervisors, Agricultural Inspectors

Source: Robert Pollin et al: Green Recovery: A program to create green jobs and start building a low-carbon economy, PERI, 2008

## 5. Contextual Drivers of Change

Phase 1 of this project concerns the identification of contextual drivers of change that could contribute to creating new and emerging risks associated with new technologies in green jobs. This phase will comprise three Work Packages:

- WP1 – the subject of this report - a review of the literature on contextual drivers of change resulting in a list of drivers;
- WP2 – a consultation exercise carried out by interviews with experts and by a web-based exercise to consolidate the list of drivers;
- WP3 – a voting exercise to prioritise the drivers and produce a candidate list for suitable drivers to be used in generating a basic set of scenarios, which will be used in Phase 3 of the project.

### 5.1. Literature Review Methodology

An initial literature review was carried out by the Health and Safety Executive's Library and Information Services, which have access to a wide range of subscription databases. Searches were carried out on the following databases:

**ASSIA** Applied Social Sciences Index and Abstracts – a database covering social services, psychology, sociology and health information.

**Ebsco Host** A portal for e-journals published by numerous publishers. It includes Tables of Contents for 26,000 journals.

**IBSS** International Bibliography of the Social Sciences – this covers all social science fields including economics, social policy and social services, political science, law, accounting and finance, health and psychology, international relations and sociology.

**OSH ROM** This contains bibliographic databases including: CISDOC (International Labour Office); NIOSHTIC (United States National Institute for Occupational Safety and Health); HSELINE; MHIDAS; RILOSH (Canada); MEDLINE OEM.

**Other (priced) databases** – Enviroline, Environmental Engineering, Compendex, BIOSIS, Economist, Management Contents, Management and Marketing Abstracts, Wilson Applied Science and Technology, New Scientist, NTIS and CAB.

Searches that focused specifically on ‘drivers’ for green or environmental jobs produced little in the way of leads, presumably because drivers themselves are not the primary focus of most of the literature and may not appear in keywords. Opening the search to green jobs generally increased the number of hits dramatically, but with less discrimination. There is a large amount of material available on green jobs, much of it fairly recent. Most of the references found to be most useful date from the last three years.

The formal searches carried out by LIS yielded over 350 hits. The project team sifted these on the basis of age, geographical coverage, accessibility of the material and relevance as indicated by the title or abstract, where available.

The formal searches were supplemented by independent searches by the project team, relying largely on the Internet, covering a range of sources and websites of relevant organisations. In addition, information on environmental drivers from earlier work by Team members was made available.

The academic press did not yield a lot of relevant information. The most useful sources proved to be reports by and for government departments and other bodies. These are written from global, European and national perspectives.

## **5.2. Global studies**

The most comprehensive global study was ‘Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World’, produced by the Worldwatch Institute and Cornell University for the United Nations Environment Programme (UNEP) as part of the joint UNEP, International Labour Office, International Organisation of Employers and the International Trade Union Confederation Green Jobs Initiative. [5] Various shorter summaries are also available.

The UNEP report considers the definition of green jobs and measurement of them. It contains a chapter on green policies and business practices, which includes a ‘Policy Toolbox’. This deals with drivers of green jobs under the categories Financial and Fiscal Shifts – shifting subsidies from fossil to renewable energy; rethinking R&D priorities; international development finance; carbon trading and ecological tax reform; and Mandates – extended producer responsibilities; eco-labelling; and energy targets and mandates. The bulk of the report deals with eight areas of work with the potential for green jobs (see Table 2), which may be useful in Phase 2 of this project.

The International Labour Office (ILO) has produced several reports taking a global view. One in particular, by Sanchez and Poschen cites key drivers for green jobs as: mapping skills requirements and skills development; climate change investment; catering for the special needs of SMEs;\* and enabling technology transfer. [6]

The Global Climate Network identifies government policy, including targets, finance and training as key drivers for low-carbon job creation. In addition it identifies adjustment policies for activities that lose jobs as a result of green job creation. [7]

---

\* Small and Medium Sized Enterprises

**Table 2: Shades of green: pro-environmental measures in major segments of the economy**

<b>Energy supply</b>	Integrated gasification/ carbon sequestration; Co-generation (combined heat and power); Renewables (wind, solar, biofuels, geothermal, small-scale hydro); fuel cells.
<b>Transport</b>	More fuel-efficient vehicles; Hybrid-electric, electric, and fuel-cell vehicles; Car-sharing; Public transport; Non-motorized transport (biking, walking), and changes in land-use policies and settlement patterns (reducing distance and dependence on motorized transport).
<b>Manufacturing</b>	Pollution control (scrubbers and other tailpipe technologies); Energy and materials efficiency; Clean production techniques (toxics avoidance); Cradle-to-cradle (closed-loop systems).
<b>Buildings</b>	Lighting, energy-efficient appliances and office equipment; Solar heating and cooling, solar panels; Retrofitting; Green buildings (energy-efficient windows, insulation, building materials, heating, ventilation and air conditioning); Passive-solar houses, zero-emissions buildings.
<b>Materials Management</b>	Recycling; Extended producer responsibility, product take-back and remanufacturing; De-materialization; Durability and reparability of products.
<b>Retail</b>	Promotion of efficient products and use of eco-labels; Store locations closer to residential areas; Minimization of shipping distances (from origin of products to store location); New service economy (selling services, not products).
<b>Agriculture</b>	Soil conservation; Water efficiency; Organic growing methods; Reducing farm-to-market distance.
<b>Forestry</b>	Reforestation and afforestation projects; Agroforestry; Sustainable forestry management and certification schemes; Halting deforestation.

Source: Green Jobs - Towards Decent Work in a Sustainable, Low-Carbon World, UNEP/ILO/IOE/ITUC, September 2008

### **5.3. European studies**

The European Commission's own reports were a very fruitful source of information. DG<sup>1</sup> Environment's website in particular contains a useful list of references. [8]

An excellent suite of reports was produced by GHK and others for DG Environment and DG Employment. In their paper 'Links between the environment, economy and jobs', they introduce Drivers of Environment Related Economic Activities - a reasonable proxy for 'green jobs'. [9] Five high level drivers elegantly capture virtually the whole picture:

- The natural environment – the stocks and quality of the natural capital which is the input to, or focus of, different economic activities
- Political, economic and social pressures – the values, opinions, and economic wealth, which influence the choices and actions of the economic actors.
- User demand and social pressure – the demand (by consumers, corporate or public buyers) for products (goods and services) that worsen/improve environmental performance directly or, through supply chains, indirectly;

---

<sup>1</sup> Directorate General

- Products and industry requirements – legal or voluntary requirements of production or products (eg pollution control regulation, product standards, eco-labelling) to achieve set levels of environmental performance.
- Economic/financial incentives – any economic or financial incentive to produce or consume certain products and services with associated environment impacts e.g. CAP, structural funds, ethical investment, taxes and subsidies

A series of annexes is referred to in the GHK report. These comprise a separate volume, which is very interesting, but has never been published. It is, however, available from DG Environment Library and Information Services. [10] Annex B includes a matrix mapping the five high level drivers across ten groups of environmental activities and giving more specific drivers.

The most important drivers *now* were found to be:

- The natural environment – long-term sustainability;
- Political, social and economic context – awareness of risks, media and politicians' interest;
- Government investment and policy activities;
- Competitiveness;
- Demand (for natural resources);
- Legislative and financial drivers.

The report goes further and considers also the drivers that are going to become the most important in the next twenty-five years.

In their reports for DG Employment, GHK consider case studies of 15 companies' responses to climate change. In a synthesis of the overall findings they identify key drivers for action, and further identify key drivers by sector. [11, 12]

The main drivers are:

- Corporate Social Responsibility (CSR) and reputation – the impact on branding.
- Competitiveness – reducing carbon dependence;
- Regulation – EU-Emission Trading Scheme and Renewables Directive;
- Physical effects of climate change – for example, exposure to risks from water shortages.

The authors also make the following observation:

- The main drivers have related to policies rather than the physical effects of climate change;
- Regulation is more important than CSR except for airlines;
- In employment terms, impacts have been in relation to skills rather than numbers employed. There is a need for new skills and upskilling, especially in technical areas.

The World Wildlife Fund issued a report 'Low Carbon Jobs for Europe', which focuses on the opportunities offered by financial stimulus to counter the global recession. [13]

## **5.4. National studies**

A range of studies relating to individual country situations was examined. These are summarised in Annex 1.

The key objective of this report is to provide a list of contextual drivers to take the scenario project forward. In the interests of brevity we have described only a small selection of the reports consulted in order to give a flavour of the range of material available. A fuller list of references consulted with brief comments is presented in Annex 1.

## **5.5. Hierarchy of drivers**

The drivers discussed so far are fairly high-level drivers, in effect groupings of drivers, which can all be unpackaged into lower level drivers. In a scenario building exercise we need to have a sufficient number and diversity of drivers to allow debate and possible regrouping. We are faced with the challenge of picking the right level in a 'hierarchy' of drivers.

At the top level – we have the environment in its broadest sense. Everything else derives from this – climate change, need for affordable and sustainable energy, sustainable manufacturing, environmental protection and public attitudes to all of these.

At the next level down 'Environment' can be divided into two key areas:

- Climate Change – the need to respond to it.
- The Supply of Natural Resources and the need to maintain them.

Below this level we can look to five or six high level drivers, for example GHK's five drivers above. The American Council for an Energy-Efficient Economy's six driver version below is essentially very similar but with the addition of technological developments (Better Mousetraps), although these are specifically aimed at energy efficiency and not green jobs more generally. [14]

- Energy Prices;
- The Supply Straitjacket;
- Climate Urgency;
- Consumer and Shareholder Activism;
- Global Competition;
- Better Mousetraps (technological developments).

In order to provide material for the next stage of Phase 1 of this project, the drivers of change referred to in the reports reviewed were extracted, collated and, where appropriate, amalgamated to produce a set of sixty-one drivers sorted by STEEP<sup>\*</sup> categories. These are presented in Annex 2. It is important to remember that the scope of the report is 'identification of key contextual drivers of change that could contribute to creating new and emerging risks associated with new technologies in green jobs by 2020', i.e. it includes potential risks to health and safety, not just the creation of green jobs. Thus drivers such as ageing population are valid, since although they do not drive the creation of green jobs, they may bring potential risks to green jobs specific to ageing.

This report will be used to inform participants – interviewees and web survey contributors – in Work Package 2, Consolidation of Drivers.

## 6. References

- [1] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - Improving quality and productivity at work: Community strategy 2007-2012 on health and safety at work, COM/2007/0062 final. Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0062:FIN:en:PDF>
- [2] Bird J. and Lawton K., *The Future's Green: Jobs and the UK Low-Carbon Transition Plan*, Institute for Public Policy Research, 2009. Available at: <http://www.ippr.org.uk/publicationsandreports/publication.asp?id=712>
- [3] *Building the Clean Energy Assembly Line*, Blue Green Alliance, 2009. Available at: [http://www.bluegreenalliance.org/admin/private\\_publications/files/BGA-Phase-II-Report-PRINT.pdf](http://www.bluegreenalliance.org/admin/private_publications/files/BGA-Phase-II-Report-PRINT.pdf)
- [4] Pollin, R., *et al*, *Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy*, Political Economy Research Institute, 2008. Available at: [http://www.peri.umass.edu/green\\_recovery/](http://www.peri.umass.edu/green_recovery/)
- [5] *Green Jobs: Towards decent work in a sustainable, low carbon world*, United Nations Environment Programme, 2008. Available at: [http://www.unep.org/labour\\_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf](http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf)

---

<sup>\*</sup> Social, Technological, Economic, Environmental and Political

- [6] Sanchez, A. B., and Poschen, P., *The social and decent work dimensions of a new Agreement on Climate Change*, International Labour Office, 2009. Available at:  
[http://www.ilo.org/wcmsp5/groups/public/---dgreports/---integration/documents/briefingnote/wcms\\_107814.pdf](http://www.ilo.org/wcmsp5/groups/public/---dgreports/---integration/documents/briefingnote/wcms_107814.pdf)
- [7] *Low-Carbon Jobs in an Inter-connected World – Summary*, Global Climate Network, 2009. Available at:  
[http://www.globalclimatenetwork.info/%2Fecomm%2Ffiles%2Fqcn\\_low\\_carbon\\_summary.pdf](http://www.globalclimatenetwork.info/%2Fecomm%2Ffiles%2Fqcn_low_carbon_summary.pdf)
- [8] *More than the sum of their parts: The link between environment and employment policies*, DG Environment, Online, accessed February 2010. Available at:  
[http://ec.europa.eu/environment/integration/employment\\_en.htm](http://ec.europa.eu/environment/integration/employment_en.htm)
- [9] *Links between the environment, economy and jobs*, DG Environment, 2007. Available at:  
[http://ec.europa.eu/environment/enveco/industry\\_employment/pdf/ghk\\_study\\_wider\\_links\\_report.pdf](http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_report.pdf)
- [10] *Links between the environment, economy and jobs: Annexes*, DG Environment, 2007. Unpublished. Available from DG Environment Library and Information Service.
- [11] Varma, A., *The Impacts of Climate Change on European Employment and Skills in the Short to Medium-Term: Company Case Studies Final Report (Volume 1)*, DG Employment, Social Affairs and Equal Opportunities, 2009. Available at:  
<http://ec.europa.eu/social/main.jsp?catId=88&langId=en&eventId=172>
- [12] Medhurst, J., *The Impacts of Climate Change on European Employment and Skills in the Short to Medium-Term: A Review of the Literature Final Report (Volume 2)*, DG Employment, Social Affairs and Equal Opportunities, 2009. Available at:  
<http://ec.europa.eu/social/main.jsp?catId=88&langId=en&eventId=172>
- [13] Ghani-Eneland, M., *Low Carbon Jobs for Europe*, World Wide Fund, 2009. Available at:  
[http://assets.panda.org/downloads/low\\_carbon\\_jobs\\_final.pdf](http://assets.panda.org/downloads/low_carbon_jobs_final.pdf)
- [14] Ehrhardt-Martinez, K. and Laitner, J. A., *The Size of the US Energy Efficiency Market: Generating a more complete picture*, American Council for an Energy-Efficient Economy, 2008. Available at: <http://www.aceee.org/pubs/e083.htm>

## 7. Annexes

### 7.1. Annex 1: Literature Sources for Drivers of Green Jobs and Potential Health and Safety Risks of Green Jobs

Organisation	Title	pp	Authors	Date	URL	Notes	Region
1 Institute for Public Policy Research	The Future's Green: Jobs and the UK low-carbon transition plan	71	Jenny Bird and Kate Lawton	Oct-09	<a href="http://www.ippr.org.uk/publicationsandreports/publication.asp?id=712">http://www.ippr.org.uk/publicationsandreports/publication.asp?id=712</a>	Identifies 'smart government intervention' as crucial. Prioritising in low-C, incentives - supply side 'push' and demand side 'pull', develop the workforce - STEM education, Skills. Useful discussion on 'what are green jobs?' Chapters 4 and 5 give more detail on incentives and skills measures.	UK
2 Institute for Public Policy Research (with Greenpeace)	Green Jobs: Prospects for creating jobs from offshore wind in the UK	58	Jenny Bird	Apr-09	<a href="http://www.ippr.org.uk/publicationsandreports/publication.asp?id=658">http://www.ippr.org.uk/publicationsandreports/publication.asp?id=658</a>	Considers prospects for offshore wind in UK. Considers drivers as: stable and sizeable domestic market; industrial activism - tax incentives, feed-in tariffs, favourable duties, R&D; skills base; job creation opportunities.	UK
3 Universidad Rey Juan Carlos	Study of the effects on employment of public aid to renewable energy sources	53	Raquel Merino Jara and Juan Ramon Rallo Julian	Mar-09	<a href="http://www.juandemariana.org/pdf/090327-employment-public-aid-renewable.pdf">http://www.juandemariana.org/pdf/090327-employment-public-aid-renewable.pdf</a>	Analysis of heavy government investment in renewables jobs. Claims that for every green Megawatt, between 4.27 and 8.99 jobs lost in other areas. Identified cheap credit as a driver. Spanish 'photovoltaic bubble'.	Spain
4 House of Commons Environmental Audit Committee	Pre-Budget Report 2008: Green fiscal policy in a recession	111		Mar-09	<a href="http://www.publications.parliament.uk/pa/cm200809/cmselect/cmenvaud/202/202.pdf">http://www.publications.parliament.uk/pa/cm200809/cmselect/cmenvaud/202/202.pdf</a>	Identifies the following drivers: green fiscal stimulus - opportunity afforded by recession, Treasury influence in banks - investigate environmental criteria for investment strategies, green tax - shift from 'goods' to 'bads', aviation taxes - regrets backtrack from per passenger to pr plane duty, motoring taxes and scrappage (since done).	UK
5 Institute for Energy Research	Green Jobs: Fact or Fiction? An Assessment of the Literature	21	Robert Michaels and Robert Murphy	Jan-09	<a href="http://www.instituteforenergyresearch.org/wp-content/uploads/2009/01/IER-Study-Green-Jobs.pdf">http://www.instituteforenergyresearch.org/wp-content/uploads/2009/01/IER-Study-Green-Jobs.pdf</a>	US report dismissive of green jobs initiatives saying many reports based on incomplete economic analysis and overstate benefits. Some good points on definition of green jobs.	USA
6 University of Illinois	Green Jobs Myths	97	Andrew P Morriss, William T Bogart, Andrew Dorchak and Roger E Meiners	2009	<a href="http://www.instituteforenergyresearch.org/wp-content/uploads/2009/03/morriss-green-jobs-myths.pdf">http://www.instituteforenergyresearch.org/wp-content/uploads/2009/03/morriss-green-jobs-myths.pdf</a>	Report critical of green jobs movement. Subsidies could lead to description of jobs as green when they aren't. Green jobs include clerical and admin jobs - shouldn't. Examines 7 'myths'.	USA
7 United Nations Environment Programme	Green Jobs: Towards decent work in a sustainable, low carbon world	376	Micjael Renner, Sean Sweeney and Jill Kubit	Sep-08	<a href="http://www.unep.org/labour_environment/PDFs/Greenjobs/JN-EP-Green-Jobs-Report.pdf">http://www.unep.org/labour_environment/PDFs/Greenjobs/JN-EP-Green-Jobs-Report.pdf</a>	Comprehensive study with worldwide scope. Looks at definition of green jobs and measurement of them. Section on Green Policies and Business Practices, including Policy Toolbox. The Policy Toolbox includes: Financial and Fiscal Shifts - Subsidy Shifts, ie between fossil and renewable energy sources, removal of 'perverse subsidies'; Rethinking R&D Priorities Stern recommends doubling efforts on energy R&D; International Development Assistance (away from hydropower); Carbon Trading and Finance; Ecological Tax	Global

Foresight of New and Emerging Risks to Occupational Safety and Health  
Associated with New Technologies in Green Jobs by 2020

	Organisation	Title	pp	Authors	Date	URL	Notes	Region
							Reform; Mandates - Extended Producer Responsibility; Eco-labelling; Energy Targets and Mandates; Promotion of Energy Alternatives. The bulk of the report looks at the main sectors for green jobs in some detail. Likely to be useful in Phase 2.	
8	United Nations Environment Programme	Green Jobs: Towards decent work in a sustainable, low carbon world: Policy messages and main findings for decision makers	36		2008	<a href="http://www.ilo.org/wcmsp5/grou ps/public/---dgreports/---dcomm/---webdev/documents/publication/wcms_098487.pdf">http://www.ilo.org/wcmsp5/grou ps/public/---dgreports/---dcomm/---webdev/documents/publication/wcms_098487.pdf</a>	Summary of full UNEP report.	Global
9	United Nations Environment Programme	Global Green New Deal: Policy Brief	40		2009	<a href="http://www.unep.org/pdf/A_Global_Green_New_Deal_Policy_Brief.pdf">http://www.unep.org/pdf/A_Global_Green_New_Deal_Policy_Brief.pdf</a>	Study based on the premise that the financial crisis is an opportunity to green the world. Use 1% of GDP to achieve Millennium Development Goals.	Global
10	United Nations Environment Programme	Background Paper on Green Jobs	20		2008	<a href="http://www.unep.org/labour_environment/PDFs/Green-Jobs-Background-paper-18-01-08.pdf">http://www.unep.org/labour_environment/PDFs/Green-Jobs-Background-paper-18-01-08.pdf</a>	A short summary of the main UN Report but without the sectoral summaries. One page on drivers of green jobs - growth in investment, business benefits, employment benefits. Policies for green jobs - the need for government action; green investment strategy; green R&D and technology transfer; international cooperation and aid; job training	Global
11	World Wildlife Fund	Low Carbon Jobs for Europe Executive Summary	8	Meera Ghani-Eneland	2009	<a href="http://assets.panda.org/downloads/low_carbon_jobs_summary_final.pdf">http://assets.panda.org/downloads/low_carbon_jobs_summary_final.pdf</a>	Recession offers opportunity to use stimulus packages to green economies. Disappointing that only 9% of EU money going to climate change goals. Includes statistics and projections to 2020 for jobs in various sectors in EU.	EU
12	World Wildlife Fund	Low Carbon Jobs for Europe	36	Meera Ghani-Eneland	2009	<a href="http://assets.panda.org/downloads/low_carbon_jobs_final.pdf">http://assets.panda.org/downloads/low_carbon_jobs_final.pdf</a>	Recession offers opportunity to use stimulus packages to green economies. Disappointing that only 9% of EU money going to climate change goals. Includes statistics and projections to 2020 for jobs in various sectors in EU.	EU
13	European Trade Union Confederation	Speeches and slides from Climate Change and Employment meeting 20 and 21 Feb 2007	-		2007	<a href="http://www.etuc.org/a/3161">http://www.etuc.org/a/3161</a>	Speeches and slides from Climate Change (CC) and Employment meeting 20 and 21 Feb 2007. Sessions covering impact of CC on employment, links between employment and CC policy in energy, transport, building and industry. Slides alone not very easy to follow.	EU
14	Global Climate Network	Low-Carbon Jobs in an Inter-connected World - Summary	6		2009	<a href="http://www.ippr.org.uk/members/download.asp?f=ecomm/files/gcn_low_carbon_summary.pdf&amp;a=skip">http://www.ippr.org.uk/members/download.asp?f=ecomm/files/gcn_low_carbon_summary.pdf&amp;a=skip</a>	Looks at low-carbon job creation in a range of countries, focusing on targets as a key driver. In summary offers the following conclusions: Clear, consistent and targeted government policy will help boost jobs numbers; Finance is critical to the creation of low-carbon economic opportunities; Training is critical to the development of low-carbon sectors; Adjustment policies should also form part of the strategy.	Global
15	Pew Centre for Global Climate Change	Review of Green Jobs Studies	8		2009	<a href="http://www.pewclimate.org/review-greenjobs">http://www.pewclimate.org/review-greenjobs</a>	Set of literature references with short summaries, mostly US.	USA

Foresight of New and Emerging Risks to Occupational Safety and Health  
Associated with New Technologies in Green Jobs by 2020

	Organisation	Title	pp	Authors	Date	URL	Notes	Region
16	Economic Policy Institute	Green Investments and the Labor Market: How many jobs could be generated and what type?	12	Josh Bivens, John Irons and Ethan Pollack	2009	<a href="http://epi.3cdn.net/3ede40f054b5406d66_q6m6b9ne5.pdf">http://epi.3cdn.net/3ede40f054b5406d66_q6m6b9ne5.pdf</a>	Calls for government stimulus to counter the recession as an opportunity to boost green jobs, over and above Obama's cap-and-trade policy. Contains analysis of the numbers of jobs that could be created by sector (US).	USA
17	European Commission	Commission Staff Working Document - Summary report on the analysis of the debate on the green paper "A European Strategy for Sustainable, Competitive and Secure Energy"	60		2006	<a href="http://ec.europa.eu/energy/strategies/2006/doc/sec_2006_150_0.pdf">http://ec.europa.eu/energy/strategies/2006/doc/sec_2006_150_0.pdf</a>	Identifies six priority areas to meet policy objectives of energy sustainability, security of supply and competitiveness. Not specifically dealing with green jobs. Includes results of on-line poll on favoured energy sources. Results perhaps surprising in that Carbon Capture and Storage came only seventh.	EU
18	ILO	The social and decent work dimensions of a new Agreement on Climate Change	40	Ana Belen Sanchez and Peter Poschen	2009	<a href="http://www.ilo.org/wcmsp5/groups/public/---dgreports/---integration/documents/briefingnote/wcms_107814.pdf">http://www.ilo.org/wcmsp5/groups/public/---dgreports/---integration/documents/briefingnote/wcms_107814.pdf</a>	Looks at impacts of CC on work, but focusing more on adaptation rather than mitigation. Drivers/areas for action - skills developments, climate change investment, special needs of SMEs, enabling technology transfer, mapping skill requirements.	Global
19	ILO	Green jobs: Facts and Figures	2		2008	<a href="http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_098484.pdf">http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_098484.pdf</a>	Short leaflet with key worldwide figures. Green jobs will be in at least four types - additional jobs - as in the manufacturing of pollution controlled devices added to existing production equipment; substitution - as in shifting from fossil to renewable energy, from land fill to recycling; elimination without direct replacement - as in reduction or banning of packaging materials and their production; many existing professions such as plumbers, electricians, metal workers and construction workers will be transformed and redefined as day-to-day skills sets, work methods and profiles are greened.	Global
20	DG Environment	Links between the environment, economy and jobs	132	GHK, Cambridge Econometrics and Institute for European Environmental Policy	2007	<a href="http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_report.pdf">http://ec.europa.eu/environment/enveco/industry_employment/pdf/ghk_study_wider_links_report.pdf</a>	Considers three categories of Environmental jobs - where environment is a primary natural resource, activities concerned with protection and management of environment, activities dependent on environmental quality. Sub-divides these into ten second-level environment-economy linkages. Useful five top-level drivers for environment related economic activities. Very useful paper. Also looks at future drivers (Chapter 8). See also related annexes below.	EU
21	DG Environment	Links between the environment, economy and jobs: Annexes	125	GHK, Cambridge Econometrics and Institute for European Environmental Policy	2007	Unpublished. Obtained from DG Environment Library	Annexes to previous document. Excellent annex B linking five high level drivers to environmental activity areas	EU
22	European Commission	The Impacts of Climate Change on European Employment and Skills in the Short to Medium-Term: Company Case Studies Final Report (Volume 1)	156	Adarsh Varma (GHK)	2009	<a href="http://ec.europa.eu/social/main.jsp?catId=88&amp;langId=en&amp;eventId=172">http://ec.europa.eu/social/main.jsp?catId=88&amp;langId=en&amp;eventId=172</a>	Set of 15 case studies of company responses to climate change. Chapter 2 is a very useful synthesis of the overall findings. The main drivers to date relate to policies rather than the physical effects of CC or immediate competitive pressures. Regulation has been more important than corporate social responsibility policies except for airlines. The main drivers were: CSR and reputation; Competitiveness; Regulation; Physical (eg water shortages). Dominant drivers for particular sectors also identified.	EU

Foresight of New and Emerging Risks to Occupational Safety and Health  
Associated with New Technologies in Green Jobs by 2020

	Organisation	Title	pp	Authors	Date	URL	Notes	Region
23	European Commission	The Impacts of Climate Change on European Employment and Skills in the Short to Medium-Term: A Review of the Literature Final Report (Volume 2)	48	James Medhurst (GHK)	2009	<a href="http://ec.europa.eu/social/main.jsp?catId=88&amp;langId=en&amp;eventId=172">http://ec.europa.eu/social/main.jsp?catId=88&amp;langId=en&amp;eventId=172</a>	Literature review linked to above report. Identifies three main forms of climate change regulation - 'traditional (standards etc), carbon pricing, innovation policy. Future policy drivers - three main types continue. Quotes McKinsey - four types of regulation required - traditional, carbon pricing, innovation support, measures to ensure potential of forestry and agriculture is addressed (mainly developing countries). Table 32 lists 32 refs and employment estimates extracted from them.	EU
24	European Commission	Commission Working Document - Consultation on the Future "EU 2020" Strategy	12		2009	<a href="http://ec.europa.eu/eu2020/pdf/eu2020_en.pdf">http://ec.europa.eu/eu2020/pdf/eu2020_en.pdf</a>	Conserving energy, natural resources and raw materials, using them more efficiently and increasing productivity will be key driver for future competitiveness of industry and economies. EC aim for Europe to lead, compete and prosper as a knowledge-based, connected, greener and more inclusive economy. Key drivers of EU2020 should be: Creating value by basing growth on knowledge; Empowering people in inclusive societies - skills innovation, entrepreneurship etc; Creating a competitive, connected and greener economy - lower and efficient energy consumption etc. Targeted regulation, emission trading, tax reform, grants, subsidies and loans, public investment and procurement policies, targeting research and innovation budgets.	EU
25	European Commission	Facts and Figures - the links between EU's economy and environment	14		2007	<a href="http://ec.europa.eu/environment/enveco/pdf/facts.pdf">http://ec.europa.eu/environment/enveco/pdf/facts.pdf</a>	Short pamphlet with various numbers and charts - EU Eco-industry, employment, polluter pays, cost of inaction, environmental policy, international competitiveness, eco-innovation.	EU
26	ILO	Green Economy and Green Jobs: Myth or Reality?	28	David Kucera (presentation at EC Sustainable development meeting)	2009	<a href="http://ec.europa.eu/research/sd/conference/2009/presentations/13/david_kucera_-_green_economy_and_green_jobs_-_myth_or_reality.ppt">http://ec.europa.eu/research/sd/conference/2009/presentations/13/david_kucera_-_green_economy_and_green_jobs_-_myth_or_reality.ppt</a>	A good summary of the prospects for green economies in four countries - US, EU27, Germany and UK. Conclusions - a reality for all except UK. References to four 'high quality' studies - US Green Recovery - PERI; EU - Links between environment, economy and jobs (GHK); Germany - Renewable Energy: Employment Effects; UK - Building a Low Carbon Economy. EU 27 core definition of environment related jobs: organic farming, sustainable forestry, renewable energy, water supply and environment related tourism.	EU
27	American Council for an Energy-Efficient Economy	The Size of the US Energy Efficiency Market: Generating a more complete picture	58	Karen Ehrhardt-Martinez and John A 'Skip' Laitner	2008	<a href="http://www.aceee.org/pubs/e083.htm">http://www.aceee.org/pubs/e083.htm</a>	Facts and figures on the potential for energy savings and the number of related jobs in the US.	USA
28	American Solar Energy Society and Management Information Services Inc.	Defining, Estimating and Forecasting the Renewable Energy and Energy Efficiency Industries in the US and in Colorado	207		2008	<a href="http://www.ases.org/images/stories/ASES/pdfs/CO_Jobs_Final_Report_December2008.pdf">http://www.ases.org/images/stories/ASES/pdfs/CO_Jobs_Final_Report_December2008.pdf</a>	Discusses definitions of green jobs and green industries with examples. Stats on US markets. Three 'scenarios' to 2030, a base case and two others - the moderate and advanced scenarios - based on assumptions that could be translated into drivers.	USA

Foresight of New and Emerging Risks to Occupational Safety and Health  
Associated with New Technologies in Green Jobs by 2020

	Organisation	Title	pp	Authors	Date	URL	Notes	Region
29	Apollo Alliance	Green Collar Jobs in America's Cities	24		2008	<a href="http://www.apolloalliance.org/downloads/greencollarjobs.pdf">http://www.apolloalliance.org/downloads/greencollarjobs.pdf</a>	A report aimed at communities, talks of 'green collar' ie decent green jobs. Create demand by: Public sector investment policies - energy efficiency in buildings, renewable energy in public buildings, green standards in public buildings, build transit infrastructure, convert official vehicles to alternative fuels, plant trees, create green space. Incentives or requirements to drive private sector investment - tax incentives, rebates, streamlined permissions for energy efficiency, renewable energy or green building, technical assistance or innovative financing; green building codes; land use and infrastructure policies to support green manufacturing.	USA
30	European Parliament Policy Department Economic and Scientific Policy	Burden Sharing: Impact of Climate Change mitigation policies on growth and jobs	44	Samuela Bassi and Jason Anderson IEEP and Onno Kuik IVM	2008	<a href="http://www.europarl.europa.eu/activities/committees/studies/download.do?file=20894">http://www.europarl.europa.eu/activities/committees/studies/download.do?file=20894</a>	Literature search plus sector by sector analysis of current situation and trends. Good reference section with summaries.	EU
31	European Commission	Investing in the Development of Low Carbon Technologies (SET-Plan) A Technology Roadmap Commission Staff Working Document	56		2009	<a href="http://ec.europa.eu/energy/technology/set_plan/doc/2009_com_investing_development_low_carbon_technologies_roadmap.pdf">http://ec.europa.eu/energy/technology/set_plan/doc/2009_com_investing_development_low_carbon_technologies_roadmap.pdf</a>	Lists main sectoral targets for EU and roadmaps for each. Relevant ones recorded	EU
32	Institution of Environmental Sciences	Environmental Scientist: The Uptake of Emerging Science into Strategic Planning	52	Martin Duckworth, Mark Everard, Joe Ravetz, John Reynolds, Sarah Bardsley, Jennifer de Lurio, Sarah Webb, John Seager and Kathryn Monk	Jul-09	<a href="http://www.ies-uk.org.uk/resources/journalarchive/envsci2009/env_sci_jul_09.pdf">http://www.ies-uk.org.uk/resources/journalarchive/envsci2009/env_sci_jul_09.pdf</a>	Global drivers of change for the future, some related to green jobs and new technologies. Relevant ones recorded.	UK
33	UK Commission for Employment and Skills (UKCES)	Scenarios for Skills in 2020, Drivers	24	SAMI (In Confidence)	2009		List of drivers of change, some relevant to green jobs, recorded.	UK
34	Natural England	Global Drivers of Change to 2060 Natural England Commissioned Report NECR030	49		2009	<a href="http://www.jmt.org/assets/johnmuir_award/global_drivers_of_change_to_2060.pdf">http://www.jmt.org/assets/johnmuir_award/global_drivers_of_change_to_2060.pdf</a>	List of Global drivers of change out to 2060, ones relevant to project recorded.	UK
35	Political Economy Research Institute	Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy	38	Robert Pollin, Heidi Garrett-Peltier, James Heintz and Helen Scharber	2008	<a href="http://www.peri.umass.edu/green_recovery/">http://www.peri.umass.edu/green_recovery/</a>	Report describes benefits of a low-carbon economy - widespread employment gains, lower unemployment, renewed construction and manufacturing work, more stable oil prices, self-financing energy efficiency. Defines green jobs as Direct, Indirect and Induced. Gives estimates of job creation figures. Annexes describe the methodology used for estimation.	USA

Foresight of New and Emerging Risks to Occupational Safety and Health  
Associated with New Technologies in Green Jobs by 2020

	Organisation	Title	pp	Authors	Date	URL	Notes	Region
36	European Commission	Renewable Energy Country Profiles	168	Rogier Coenraads, Gemma Reece, Corinna Klebmann, Mario Resch, Anne Held, Gustav Resch, Christian Panzer, Inga Konstantinaviciute, Tomas Chadim	2008	<a href="http://isi.fraunhofer.de/isi/publ/download/isi08b33/progress-renewable-energy-countryprofiles.pdf?pathAlias=/publ/downloads/isi08b33/progress-renewable-energy-countryprofiles.pdf">http://isi.fraunhofer.de/isi/publ/download/isi08b33/progress-renewable-energy-countryprofiles.pdf?pathAlias=/publ/downloads/isi08b33/progress-renewable-energy-countryprofiles.pdf</a>	A detailed EC paper describing the renewable energy profiles of a number of EC countries. Includes national commitments, government investments and incentives and a breakdown of the technologies used in each country.	EU
37	European Commission	Investing in the Development of Low Carbon Technologies (SET-Plan) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions	14		2009	<a href="http://ec.europa.eu/energy/technology/set_plan/doc/2009_comm_investing_development_low_carbon_technologies_en.pdf">http://ec.europa.eu/energy/technology/set_plan/doc/2009_comm_investing_development_low_carbon_technologies_en.pdf</a>	See 31 above.	EU
38	Technology Review	Solar Energy: New Technologies in Spain	8		2007	<a href="http://www.technologyreview.com/microsites/spain/solar/docs/TR_Spain_solar.pdf">http://www.technologyreview.com/microsites/spain/solar/docs/TR_Spain_solar.pdf</a>	Article on the history and future of all forms of solar energy in Spain, includes solar concentrators.	Spain
39	Technology Review	Desalination: New Technologies in Spain	8		2007	<a href="http://www.technologyreview.com/microsites/spain/water/docs/Spain_desalination.pdf">http://www.technologyreview.com/microsites/spain/water/docs/Spain_desalination.pdf</a>	Article on the history, technology and futures of desalination in Spain.	Spain
40	Technology Review	Wind Power: New Technologies in Spain	8		2008	<a href="http://www.technologyreview.com/microsites/spain/wind/docs/spain_wind_brochure.pdf">http://www.technologyreview.com/microsites/spain/wind/docs/spain_wind_brochure.pdf</a>	Article on the history and futures of wind energy technology in Spain. A good example of how government incentives can stimulate a rapid expansion in renewables. In this case by Government Decrees.	Spain
41	European Commission	Adapting to climate change: Towards a European framework for action. White Paper	16		2009	<a href="http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52009DC0147:EN:NOT">http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52009DC0147:EN:NOT</a>	Strategy paper on coping with climate change. Section on 'instruments' focuses mainly on financing and insurance but not specifically related to job creation. Reference to European Economic Recovery Plan (EERP).	EU
42	Journal of the American Medical Association (JAMA)	Expansion of Renewable Energy Industries and Implications for Occupational Health	3	Steven A. Sumner and Peter M. Layde	2009	JAMA, August 19, 2009, Vol 302, No.7. pp797-789	A large number of renewable energy technologies are safer in the fact that they reduce or remove the fuel extraction phase. Although this is not the case with biomass. Electrical issues are likely to provide the greatest risk. Other H&S risks of renewables are discussed.	USA
43	United Federation of Danish Wokers and the Ecological Council	Green Jobs: Examples of energy and climate initiatives that generate employment	48	Christian Ege, Trine Bang Hansen, Jeppe Juul and Vibeke Ero Hansen	2009	<a href="http://ecocouncil.dk/index.php?option=com_content&amp;view=section&amp;layout=blog&amp;id=32&amp;Itemid=177">http://ecocouncil.dk/index.php?option=com_content&amp;view=section&amp;layout=blog&amp;id=32&amp;Itemid=177</a>	Paper that outlines a number of proposals to combat the economic and environmental crisis in Denmark. It describes renewable technologies to be embraced, how to change the transport system and energy savings that can be made.	Denmark
44	Energy Policy	Renewable Energy and Employment in Germany	8	Ulrike Lehr, Joachim Nitsch, Marlene Kratzat, Christian Lutz	2008	Energy Policy. Vol 36. 2008. pp108-117	A paper that outlines the results of a study that models the impact of policies for an increasing share of renewable energy on the labour	Germany

Foresight of New and Emerging Risks to Occupational Safety and Health  
Associated with New Technologies in Green Jobs by 2020

	Organisation	Title	pp	Authors	Date	URL	Notes	Region
				and Dietmar Edler			market in Germany. The net effect of 2 policy scenarios for Germany were calculated to 2030.	
45	Journal of Cleaner Production	The Quantitive and Qualitative Impacts of Clean Technologies on Employment	24	M. Getzner	2002	Journal of Cleaner Production. Vol 10. 2002. pp305-319	An Austrian paper that describes the results of a survey of companies in 5 European countries on the impact of clean technologies on all aspects of employment.	EU
46	International Journal of Technology Management	Cleaner Production, Employment Effects and Socio-economic Development	21	Michael Getzner	1999	International Journal of Technology Management. Vol 17. No. 5. 1999. pp522-543	An Austrian study of the employment effects of clean technologies	Switzerland
47	Trade Unions as Environmental Actors: The UK Transport and Workers' Union	Capitalism Nature Socialism	31	Michael Mason and Nigel Morter	1998	Capitalism Nature Socialism. Vol 9. Issue 2. 1998. pp 3-34	Essay which aims to establish the role of British Trade Unionism in extending ecological regulation and in expanding the public discourse of ecological politics. Britain's 2nd largest Union, the Transport and General Worker's Union (T&G) is studied closely in relation to its involvement in environmental issues.	UK
48	Global Climate Network	Low-carbon Jobs in an Interconnected World: Literature Review	14		2009	<a href="http://www.globalclimatenetwork.info/uploadedFiles/globalclimatenetwork/low_carbon_jobs_lit_review.pdf">http://www.globalclimatenetwork.info/uploadedFiles/globalclimatenetwork/low_carbon_jobs_lit_review.pdf</a>	See ref 14 above.	Global
49	DG Environment	Environment and labour force skills	77	Allister Slingenberger et al. ECORYS	2008	<a href="http://ec.europa.eu/social/main.jsp?catId=370&amp;langId=en&amp;featuresId=63&amp;furtherFeatures=yess">http://ec.europa.eu/social/main.jsp?catId=370&amp;langId=en&amp;featuresId=63&amp;furtherFeatures=yess</a>	Report on the potential for environment-related employment in the EU 25, looking at skills requirements and how they will change as jobs change. Identifies the risk of a shift to low skills work associated with new jobs favoured by climate policies.	EU

## 7.2. Annex 2: Drivers for Green Jobs and Potential Health and Safety Risks in Green Jobs

	<b>SOCIAL</b>	
	<b>Demographics</b>	
1	Increasing population	Increasing population, worldwide as well as in Europe, is likely to increase the use of energy and natural resources. Thus population increase drives the need for ever more efforts to improve energy efficiency, sustainable development, recycling and the environmental impact of human activity.
2	Ageing population and workforce	Increasing numbers of older people in the general population and in the workforce will have an impact on energy use and the potential for health and safety issues. Older people tend to use more energy in the home, but less on transport. Older workers may be more susceptible to new technologies and substances in the workplace.
3	Baby-boomer retirement bulge 2010-2020	As many post-war baby-boomers reach retirement there may be a loss of essential skills in the workplace and a resulting threat to health and safety in work generally, including green jobs.
4	More women in the workforce	There may be gender issues associated with new substances and new work processes in green jobs.
5	Increasing urbanisation	Increasing urbanisation of populations may impact on energy use, use of natural resources, pollution etc., driving the need for mitigation measures such as energy efficiency, renewable energy, recycling etc.
6	Increasing single living, driven by family breakdown, lifestyle choices, increasing longevity.	Single households are likely to be less energy efficient than multiple occupancy houses, driving the need for mitigation measures such as energy efficiency, renewable energy etc.
7	Increasing levels of obesity	Health and safety risks attributable to obesity in general will apply to green jobs and may be particularly relevant in certain jobs, for example in susceptibility to the effects of new or substitute chemicals.
8	Migration	Shortage of the skills necessary in some green jobs means that migrant labour is being used to fill vacancies. Migrant workers can be at greater risk of accidents and work-related ill-health than local staff owing to language and cultural issues. They are also typically more often employed in more risky jobs and in more precarious conditions, benefit less training, etc. and are therefore more at risk. Climate change might modify migration patterns (e.g. owing to scarcity of water in some regions of the world, etc.) and new populations of migrant workers with different characteristics might be found in the EU; or the migration flow might also be modified.
	<b>Public Opinion</b>	
9	Increasing consumer and investor concerns about energy and other industry sectors' responsibility.	Public opinion and competitiveness issues could drive Corporate Social Responsibility programmes leading to companies making efforts to operate more efficiently and sustainably. Public opinion, pressure groups, campaigns etc will influence governments.
10	Growing intolerance of risk	The general public's growing intolerance of risk, coupled with their inability to properly assess risk, may lead to a reluctance to adopt new (green) technologies. On the other hand they may favour newer renewable and sustainable technologies over older, dirtier technology. Improved risk communication might affect people's attitudes.
11	People's reaction to climate change and the extent to which they regard human activity as responsible.	If people believe that CO <sub>2</sub> emissions play a major part in global warming, then they will be increasingly likely to support low-carbon energy sources. Climate change deniers will take a different view. Companies and government will be influenced by these views.
12	Public opinion on environmental protection	Public opinion on environmental protection and opposition to activities that damage the environment could drive green jobs in protection. However, shortages of essential natural resources could eventually result in conflict

Foresight of New and Emerging Risks to Occupational Safety and Health  
Associated with New Technologies in Green Jobs by 2020

	generally.	between our material needs and protection of the environment.
13	Generational Attitudes	Social scientists define different cohorts in society – Baby Boomers and Generations X, Y and Z. Each group has different attitudes to and approaches to communication ('digital migrants' compared to 'digital natives'), learning, engagement with politics etc. The younger groups may be more questioning and challenging. They will have different attitudes to environmental issues.
14	Increasing demand for organic food	Increasing demand for organic food is likely to generate more jobs in the production of organic food.
15	Increasing demand for low-carbon and environmentally friendly products and services	Increasing demand for such items and services will driver increases in jobs involved in their production and delivery.
	<b>TECHNOLOGICAL</b>	
	<b>Technologies for Climate Change Mitigation</b>	
16	Carbon Capture and Sequestration (CCS)	Successful testing and development of this technology will result in increasing numbers of jobs in this sector, although numbers by 2020 may not be great. Although this qualifies as green in that it reduces carbon emissions to the atmosphere, it could be argued that it is not a long-term sustainable solution.
17	Clean Coal Technologies	Successful testing and development of this technology will result in increasing numbers of jobs in this sector, although numbers by 2020 may not be great. Although this qualifies as green in that it reduces pollutant emissions to the atmosphere, it could be argued that it is not a long-term sustainable solution.
18	Renewable Energy Technologies	Developments in renewable energy technologies and/or expansion in these areas would create jobs. The technologies include: wind, wave, solar PV, solar heating, geothermal energy, air exchange method, small-scale hydroelectricity, biofuels, biomass.
19	Other emerging energy technologies	Developments and expansion in novel energy solutions will lead to jobs in those areas. For example, combined heat and power, microgeneration, hydrogen, energy storage technologies, including batteries.
20	Nuclear energy	The extent to which nuclear energy contributes to the future energy supplies will affect the demand for energy from other sources, including green energy sources.
21	Smart Grid Technologies	Development of smart grid technology, resulting in more efficient use of power, would lead to green jobs. Development of a smart grid will require corresponding development of Information and Communications Technologies (ICT) (see below) to control the grid.
22	Development of energy efficient transport.	Increasing development and production of greener transport technologies, for example electric, hybrid and hydrogen (fuel cell or internal combustion) vehicles.
	<b>Technologies for Climate Change Adaptation</b>	
23	Coastal defences, Reinforcing buildings, Water management, Harvesting, Adaptation in agriculture - agroforestry.	Efforts to make the most efficient use of land could lead to increased food production and green jobs.
24	Geoengineering	Developments in technologies such as ambient air CCS and ocean seeding, designed to remove carbon from the wider atmosphere as opposed to capture at source, or management or exploitation of methane gas hydrates would create jobs in these areas. Unlikely to be large numbers by 2020. Although these qualifies as green in that they reduce carbon dioxide levels in the atmosphere, it could be argued that they are not long-term sustainable solutions.
	<b>Other Environmentally Relevant Technologies</b>	
25	Growth in Waste Management and	Growth in waste management and recycling activities, driven by declining natural resources, environmental legislation and public opinion. Recycling is a

Foresight of New and Emerging Risks to Occupational Safety and Health  
Associated with New Technologies in Green Jobs by 2020

	Recycling	dangerous sector in which to work.
26	Developments in Information and Communications Technologies (ICT)	Increasing use of computers will require more energy. Much software contains redundant code reducing the efficiency of the computers. More energy efficient computers, in terms of both hardware and better software will reduce the inevitable increase in energy use in this area. Computers will be essential for control of, for example smart grid technology and smart appliances, optimisation of energy use in buildings and transport.
27	Development of smart appliances	Alongside a smart grid we will need smart appliances – appliances that can communicate with energy suppliers and take their own decisions about when to switch on and off in order to use electricity at the best price. In an industrial situation there could be risks associated with autonomous machines switching themselves on and off.
28	Developments in robotics and automation.	Robots will increasingly be used to replace humans in dangerous jobs. They may also replace humans in green jobs. For example, use of computerised tractors in farming is already with us. 'Precision farming' uses global positioning technology and satellite images to make the best use of land.
29	Nanotechnology	It is likely that nanotechnologies will contribute to green issues in various ways, for example changes in manufacturing resulting in saving of natural resources, novel materials, desalination, changes in food production, carbon nanotubes in new battery designs. New materials and nanoparticles may bring health and safety risks as well as environmental risks.
30	Biotechnologies	Use of Synthetic Biology and genetic modification techniques to generate desired traits in crops and animals may have health and safety implications. Genetic testing could be used to identify those at particular risk from toxic substances.
31	Green Chemistry	Substitution of chemicals for environmental purposes may inadvertently result in changes in health and safety risks.
32	Sustainable Manufacturing	Manufacturing making use of low-carbon technologies, renewable and non-toxic materials, recycling, low waste has strong green credentials, but new methods and new or substitute substances may bring changes in health and safety risks.
	<i>Wildcard:</i> * Major incident involving renewable technology	
	<b>ECONOMIC</b>	
33	European economic growth to 2020	The state of European economies will have a significant effect on the availability of resources with which to tackle environmental issues. Will the European economy grow? Has the recession ended? Will another global financial crisis occur? Will the European economy be favourable to investment in green technologies?
34	Decreasing oil availability and increasing and more volatile oil prices.	As easy to reach oil resources decline and demand increases, there will be increasing pressure to improve fuel efficiency and to seek alternative, renewable fuel sources. In addition to its transport and heating uses, oil is a feedstock for many industrial processes and so shortage and increasing prices will drive efficiency improvements and use of alternative sources, such as biomass.
35	Decreasing availability of gas and increasing and more volatile gas prices	As easy to reach gas resources decline and demand increases, there will be increasing pressure to improve fuel efficiency, energy efficiency in buildings and to seek alternative, renewable fuel sources. In addition methane from biomass and novel natural sources, eg gas hydrates may be introduced.
36	Decreasing price of renewable energy	As the cost of energy from renewable sources decreases, whether as a result of technological innovation or as a result of subsidies and incentives, its popularity and rate/extent of adoption will increase.
37	Shortages and increasing prices of natural resources	Increasing competition for natural resources from emerging economies and increasing use at home will lead to increased efforts in areas such as

\* Wildcards are low frequency, high impact events.

Foresight of New and Emerging Risks to Occupational Safety and Health  
Associated with New Technologies in Green Jobs by 2020

	(other than energy)	recycling, more efficient production and reduction of waste. Companies adopting more sustainable business practices to hold down costs by reducing waste.
38	Global Recession	Governments are seeing the need for financial stimulus to deal with the recession as an ideal opportunity to green their economies
39	Globalisation	Globalisation leads to increasing movement of goods and people, contributing to global energy use and therefore driving the need for efficiency. In addition, competition from emerging economies drives cost cutting in Europe resulting in greater efficiency. Increasingly demanding climate change regulations affecting multinational businesses could also drive efficiency gains.
40	Trade liberalism versus protectionism	The current global economy has been enabled by, amongst other factors, increasingly liberal trade conditions. Continuation or re-emergence of recession could drive a return to protectionism. This could affect prices and availability of natural resources, including energy.
41	Shifts in World Economic Power	Emerging economies such as China and India are growing more quickly than OECD countries and their economic influence will increase accordingly. This could lead to increasing political influence, for example China's ability to affect decisions on carbon targets at the Copenhagen conference in 2009.
42	Employment - need to create jobs	Green jobs tend to be more labour intensive. However, some argue that green policies cause a net loss of jobs overall. Others argue that the environmental crisis that could occur as a result of climate change will threaten more jobs than environmental policies. Every green job contributes to greening of jobs in other parts of the economy.
43	The attitudes of insurance companies to developing green technologies.	Businesses need to be able to get cover for speculative ventures
44	Creation of a suitable financial climate to enable investment in green technologies.	Businesses need to be able to raise capital to invest in green technologies. Many companies involved in this area are SMEs. Legislation to remove investment uncertainty and the availability of credit are essential drivers. Recognition by Venture capital firms that green technology development can give significant business opportunities. Many companies driving renewable energy solutions are SMEs. More established companies can use green technologies to stay at the cutting edge, expand sales and exploit new export markets.
45	Availability of capital for investment	Government action to encourage banks and venture capitalists to back green projects. Government to underwrite borrowing.
46	Market opportunities offered by environmental products	Global market for environmental products and services (efficiency, recycling, water sanitation and efficiency and sustainable transport) is currently €1000 billion, and could reach €2200 billion by 2020.
47	Growth of the EU	Potentially bigger markets for green technology.
48	The need for food security	Increasing energy costs could drive decreasing transport of food. and increasing local food production.
49	The need to replace ageing infrastructure.	Ageing infrastructure and networks need replacement over the coming decade, e.g. Electricity grids, New forms of energy generation require new infrastructure. Massive amount of activity required will affect size and shape of EU workforce. 'Smart' infrastructure requires manufacture, installation and maintenance.
50	Availability of a sizeable domestic market for green products and services and a requirement for local content	A ready domestic market and a need for local input will make developments more attractive to potential investors.
	<i>Wildcards: New global financial crisis.</i>	
	<b>ENVIRONMENTAL</b>	
51	Global Climate Change Initiatives	UN Initiatives - Kyoto, Copenhagen etc
52	EU Initiatives	European Directives and Regulations, including; Directive on the Promotion of the Use of Energy from Renewable Sources (2008); the Biofuels Directive

Foresight of New and Emerging Risks to Occupational Safety and Health  
Associated with New Technologies in Green Jobs by 2020

		(2003); Directive on the Energy Performance of Buildings (2003); Regulation on CO2 Emissions of Passenger Cars and the Eco-design Directive.
53	National Initiatives	The extent to which individual member states comply with EU initiatives.
54	Increasing responsibility on producers	Extended producer responsibility' laws (requiring companies to take back products at the end of their useful life) for all types of products and the requirement for eco-labels for all consumer products to ensure that consumers have access to information needed to make responsible purchases will encourage manufacturers to design and market more eco-friendly products.
<b>Physical Effects of Climate Change</b>		
55	Increasing frequency of natural disasters and/or freak weather	Increasingly extreme weather will drive public opinion on climate change, strengthening the position of pressure groups and potentially influencing government policies.
56	Increasing need to manage water supplies	Climate change may lead to water shortages in parts of the world, eg southern Spain. Activities to store water and to use less water will become increasingly important. Desalination might become more important.
57	Food security	Climate change may drive the need for more efficient and/or more local food production. This could lead to an increase or decrease in jobs, depending on the solutions adopted.
58	Increasing importance of 'uplands'.	As climate change affects lower lying areas, higher ground might become more important in farming and forestry, possibly bringing new challenges.
<i>Wildcards</i> : Release of climate change e-mails Increase in natural disasters/freak weather		
<b>POLITICAL</b>		
<b>Government Interventions</b>		
59	Actions to encourage research and development	Develop clear criteria to prioritise research and development needs in order to target research and innovation budgets towards environmentally friendly activities. Strengthen, optimise and expand energy research capabilities. Promote the development of technology clusters.
60	Actions to develop education and training to develop the necessary skills.	Many observers fear that a shortage of skills will hamper the development of green activities and therefore green jobs. Action to encourage education in science, technology, engineering and mathematics, to identify the skills gaps and to provide relevant training will promote the creation of green jobs. Skill levels are important to health and safety.
61	Action to ensure that regulation enables rather than stifles development of green jobs. Removal of the barriers to the creation of green jobs.	Ensuring that the regulatory regime is used in the drive to develop greener technologies, products, and services and thus green jobs. For example, faster and easier permissioning procedures for green projects, including land use policies and planning permission, building codes, energy efficiency standards (for appliances, vehicles, etc.), targets for producing renewable energy and proportionate health and safety legislation.
62	A favourable tax regime for environmental activities	Tax incentives for green activities, favourable customs duties. Taxation of high carbon and polluting activities, eg aviation and motoring, removal of 'perverse' subsidies on fossil fuel activities in some cases. Shifting of tax from 'goods' to 'bads'.
63	Financial incentives	Grants, subsidies and loans, for renewable and low carbon energy projects, car scrappage schemes, feed-in tariffs
64	Governments to target recession busting financial stimulus	Many governments are seeing the need to boost their economies in the wake of the global recession as an opportunity to green their economies by targeting environmentally sound activities. In addition to the availability of finance, it may be that costs of major engineering projects will be lower over the next few years as contractors compete for business in a reduced market.
65	Carbon Markets	Carbon Markets: Fixing the current shortcomings inherent in carbon trading and Kyoto Protocol related innovations such as the Clean Development Mechanism so that they can become reliable and adequate sources of funding for green projects and employment. Carbon pricing via EU's Emissions Trading Scheme (EU-ETS).
66	Public sector investment policies	The public sector should lead on energy efficiency by retrofitting energy efficiency measures to public buildings; using renewable energy systems on public buildings and ensuring that new public buildings are built to green standards. It should undertake initiatives to boost public transport and energy

Foresight of New and Emerging Risks to Occupational Safety and Health  
Associated with New Technologies in Green Jobs by 2020

		efficient vehicles to convert local government fleets to alternative vehicles or fuels. Procurement policies should favour green products and services from local providers.
67	Tax incentives, rebates, reduced fees or streamlined permitting for private building owners that invest in energy efficiency, renewable energy, or green building.	Technical assistance or innovative financing for private investment in renewable energy, efficiency, green building, alternative vehicles or green space. Green building codes, energy conservation ordinances, or other requirements for new green buildings or retrofits of existing buildings. Land use and infrastructure policies to support green manufacturing companies.
68	Existence of adjustment policies	Where jobs may be lost as a result of the creation of green jobs, action to retrain and redeploy displaced staff may reduce the risk of opposition to green job creation.
69	Increased house building to cope with demand	Requirements for new housing to be energy efficient or even 'carbon neutral' will increase the number of green jobs in construction.
	<i>Wildcards:</i> Global instability disrupts supplies of energy and other resources. Terrorism.	