

**International Journal of Labour Research**

**2010**

Vol. 2

Issue 2

Climate change  
and labour: The need  
for a “just transition”

INTERNATIONAL LABOUR OFFICE, GENEVA

# Contents

121

*Preface*

Dan Cunniah

125

*Building a Just Transition:*

*The linkages between climate change and employment*

Anabella Rosemberg

163

*Workers' rights in climate change policies: The case of adaptation  
programmes in Small Island Developing States*

Nazmul Huq and Jean Hugé

187

*Climate change, poverty and migration processes  
in Chiapas, Mexico*

Laura Elena Ruiz Meza

211

*Employment opportunities from climate change mitigation policies  
in the Netherlands*

Jerry van den Berge

233

*BlueGreen Alliance: Building a coalition  
for a green future in the United States*

David Foster

245

*The greening of the offshore energy sector in the North Sea*

Miguel Esteban, David Leary, Qi Zhang, Agya Utama and Keiichi Ishihara

269

*The foundations for extending green jobs:*

*The case of the rail-based mass transit sector in North America*

Jonathan Michael Feldman

293

*Supporting a just transition:*

*The role of international labour standards*

Lene Olsen

# Building a Just Transition

*The linkages between climate change  
and employment*

**Anabella Rosemberg**

International Trade Union Confederation

## Introduction

Climate change has been at the centre of several scientific debates in the last decades, but only in recent years has it made its place in the “mainstream” politics and in public opinion.

This is the outcome of a few interrelated factors which range from the increase in the number of extreme weather events around the world to better media coverage of climate negotiations, the latter also influenced by a higher participation of world leaders in climate-related discussions.

The union movement has not been immune from this increased public awareness. In the last years, trade unionists have created an international group on climate change (with over 100 national centres represented) and increased four-fold the number of its delegates to the UN climate discussions. The number of debates and activities on climate change has also increased substantially. The employment aspects of climate change as well as the need to secure a space for the international union movement in an eminently global debate about solidarity, development and equity have been fundamental drivers.

High expectations around the climate negotiations in Copenhagen in 2009 and the disappointment that emerged following their weak outcomes reinforced the public feeling that United Nations multilateralism might not be able to solve complex issues. However, the consequences of the economic crisis, which set the scene for the negotiations, should not be ignored. In 2009, when governments met in Copenhagen to discuss a new climate agreement, many economies around the world were badly hit by the global economic crisis and employment prospects were not encouraging (Global Unions, 2010).

The discussions in Copenhagen irremediably linked climate change to the traditional economic and political agendas of governments, and in this revealed the limited importance that the latter had been given in the UNFCCC negotiations.

The realization that the “realpolitik” aspects of climate change had to be dealt with along with scientific aspects might be one of the most interesting outcomes of the Copenhagen discussions. For several actors, including the labour movement, it was clear by then that unless a “job-friendly rationale” was developed around climate change, there was a risk for this issue to be seen only under a “gloom and doom” perspective, which was not going to be sufficient for getting governments to act.

This paper will explore some aspects of the employment/climate change nexus. It will also consider some of the possible public policy options that have been identified by several actors as sound climate policies which protect the broader social needs of communities. Finally, this paper will seek to highlight research gaps that need to be addressed.

## Natural allies? Environmental and social crises, originally linked but separately addressed

When, in 1992, governments met in Rio and agreed on the fundamental link between ensuring social justice, protecting the environment and promoting economic security, hopes emerged on the capacity of our societies to transform themselves towards sustainability. However, 20 years later, the limits of our economic system have been reached, inequalities have never been higher and the planet's natural resources are already showing signs of exhaustion.

In terms of social crisis, it may well be said that our societies have reached a tipping point. Reliable indicators show that in the last 15 years income inequality has grown (ILO, 2008), workers are gaining a decreasing share of global GDP to sustain their livelihoods (Torres, 2009; ILO, 2008) and long-term strategies concerning social progress and sustainability have been undermined by corporations' fixation on the short-term benefits to shareholders. Long-term trends in income distribution are also exacerbated by the instability of prices of food or fuel, which has put the livelihoods of millions in peril.

In terms of the environment, there are no doubts on the increase of environmental thresholds: the proliferation of extreme weather events as a consequence of climate change, the incapacity of our societies to stop the loss in biodiversity, the long-term effects on our health of the proliferation of chemical substances... Those are but a few examples of the multiple environmental challenges our societies are facing. Unsustainable consumption and production patterns make humanity's environmental footprint 31 per cent larger than the planet's capacity to produce these resources (WWF, 2008). A recent figure highlights this in a stark manner: "In 2010, the worldwide human population is projected to use 150 per cent of the resources the Earth can generate in a year" (Global Footprint Network, 2010).

Moreover, these excesses are not even sufficient to guarantee access to resources to all: nearly 900 million people lack access to drinking water (WHO, 2010), 3 billion people do not have access to reliable sources of energy for heating and cooking (UNDP and WHO, 2009), 1 billion people suffer from hunger (United Nations, 2010) and almost half of the world's population – over 3 billion people – live on less than US\$2.50 a day (Shah, 2010).

The argument that the expansion of the economic system as we know it will make it possible for those people to secure their rights is simply not realistic. If the world's inhabitants generated greenhouse gases at the same rate as some developed countries, we would need nine planets (UNDP, 2007).

This highlights the need to relate the environmental and social crises to the economic system that generated them. An in-depth analysis of the current global crises (food, energy, climate, finance, economy) (ITUC, 2009a;

Shah, 2008) reveals a common thread in their root causes: an unregulated, consumption-oriented and socially unjust economic model.

Climate change is a demonstration of the unequal way in which benefits and costs are shared under our current model of production and consumption: its negative consequences will be mostly felt by those who least caused it (Parry et al., 2007). If temperatures increase above 2°C from pre-industrial levels, 75 to 250 million people across Africa could face water shortages by 2020; crop yields could decrease by 30 per cent in Central and South Asia; and agriculture fed by rainfall could drop by 50 per cent in some African countries by 2020 (UNDP, 2009).

Climate change shows the profound links between the environmental challenge and the social and economic order. Its solution challenges the clustered way in which we have been dealing with environmental or social issues in the past.

In this regard, climate debates have given some attention to the negative impacts of inaction on poverty eradication and other development goals. Another issue that has gained some coverage is the employment opportunities and challenges coming from a greener economy (as explored below). However, those links are unidirectional. Climate policies are the driver and social dimensions are part of the consequences, they are at the receiving end of the policy.

The positive feedback coming from the implementation of coherent climate and social policies is still an underdeveloped issue. For example, a citizen who receives adequate health-care provision is a citizen who is more resilient to climate change. Equally, workers assured of being accompanied in their job search if they are currently in a sector facing challenges, could also be more proactive in their support for the development of a new and greener economic plan. This shows that social protection schemes contribute to climate change adaptation and mitigation.

### An employment-blind negotiation

Since the signature of the UNFCCC in 1992, and the negotiation of the Kyoto Protocol, international climate negotiations dealt only marginally with social and economic issues. It was acknowledged that emission reductions implied changes in several economic sectors. However, the small emission reduction target agreed upon in Kyoto did not generate major changes in any of them. This said, the non-ratification of the Kyoto Protocol by the United States was based on concerns about the Protocol's impacts on the American economy. Those supposed impacts were not countered at that time by any other research. These arguments could be taken by others now that stronger emission-reduction efforts will be needed. In order to avoid a similar scenario, a better understanding of the economic and social aspects of climate policies seems a priority.

In the last two years, the economic aspects of climate change have become more visible. Identifying the costs of climate policies was instrumental for providing an economic approach to climate policies. Based on pioneering research, Stern stated that the costs of fighting climate change (costs estimated to 1 per cent of annual GDP by 2050<sup>1</sup>) were far below the costs of inaction (estimated at 5–20 per cent of the global GDP, with poor countries suffering in excess of 10 per cent of their GDP). Mitigation and investments in a low-carbon society are thus more economically rational, and investments in a low-carbon society should be considered as responding to economic rationality (Stern, 2007).

However, macroeconomic and long-term considerations linking climate change with national policy priorities have not been sufficient yet to motivate governments to take action for the welfare of all in a decade or more. If the negotiations on climate change were to succeed, it would be through the integration of immediate domestic concerns (jobs, growth, and poverty) in climate decisions, as a means to secure support.

One aspect that was blatantly ignored was employment.

In preparation for the UNFCCC conference in Bali, Indonesia (3–14 December 2007), a strong statement was released by the trade union movement, where the link between employment and climate change was clearly stated:

The effects on the economy – including on employment – will be catastrophic if ambitious measures are not taken to reduce GHG emissions. While employment protection has often been used by certain developed country governments as a reason for not engaging in GHG emissions reductions, emerging evidence indicates that climate change mitigation has positive net employment effects. [...] Trade unions are aware that certain sectors will suffer from efforts aimed at mitigating climate change. Sectors linked to fossil fuel energy and other energy intensive sectors will be profoundly transformed by emissions reduction policies (ITUC, 2007).

Global unemployment has risen by 34 million since the crisis began, with millions more workers unable to find regular employment but absent from unemployment statistics (Global Unions, 2010). In this context, domestic policy priorities, such as employment creation, remain a priority for governments, even as the climate crisis knocks at their doors.

While employment concerns might not be the only reason why governments do not engage in climate policies, if climate policies became “job-literate” and able to address the economic, social and employment consequences of climate change, this would certainly facilitate consensus-building for an ambitious mandate on emission reductions.

---

1. These annual costs correspond to a stabilization at 500–550 ppm CO<sub>2</sub> equivalent.



## What do we know about the relationship between climate change and employment?

This section will examine some of the evidence found on the linkages between climate change and employment. It deals with the employment impacts of climate change mitigation (policies to reduce greenhouse gas emissions) and adaptation policies (policies to anticipate the consequences of climate change) and examines their effects on different sectors from an environmental, economic and political perspective.<sup>2</sup>

Unfortunately, to date, research in those three areas is scarce. It is easy, if not trite, to say that when the economy is affected, employment is as well. However, it is harder to analyse how these impacts will be distributed, as impacts on the economy might not bring about immediate and visible changes in employment as a whole. Instead, some sectors will be adversely affected by these changes while others will benefit from them.

### The impacts of climate change on employment

Impacts in the short to medium term will not be the consequences of temperature increases as the latter will be moderate and might even have positive impacts, by increasing agricultural yields in some regions for instance (under an optimistic scenario in which there is less than 2°C increase in global average temperatures). The negative impacts on employment will be the result of extreme weather events such as droughts, cyclones and/or floods. They will also arise from slower processes such as sea level rise.

The greater incidence of extreme weather events will affect urban employment because damage to transport, industrial infrastructures and settlements affects the ability of workers to commute and/or to find alternatives when workplaces have to close. An illustration of this is the near destruction of New Orleans by Hurricane Katrina, which resulted in the loss of about 40,000 jobs. Another anticipated impact is the displacement of workplaces to areas less exposed to environmental risks (further away from the sea or in zones less prone to cyclones). In a globalized economy, it is hard to predict whether these displacements will take place within the same country or be transboundary.<sup>3</sup>

---

2. The section is based on UNEP and Sustainlabour (2008). Anabella Rosemberg and Laura Martin were the lead authors of this chapter.

3. Foreign investments are highly influenced by “Country Risk” notations. A certain number of risk agencies, such as the COFACE, already incorporate indicators on the level of infrastructure which might be affected in a disaster-prone country. In its services for members, the Investor Network on Climate Risks includes advice regarding the ways in which businesses – their facilities, suppliers, customers, raw materials, etc. – are susceptible to the physical impacts of climate change including sea level rise, changing weather patterns and increased intensity and frequency of severe weather events such as droughts, floods and storms.

Rural employment will also be affected by climate change. Due to a greater incidence of heavy precipitation and the damage to crops this entails, it is anticipated that employment in the agricultural sector will be adversely affected, especially seasonal jobs that depend on harvesting and crop-processing. This is illustrated by Ruiz (in this issue), who links the decrease in employment opportunities due to climate change to migrations. It is hard to draw a simple cause-and-effect relationship between migration and climate change. People migrate for numerous reasons. However, a recent study has revealed that climate change is one of the key reasons behind male migration from Chiapas towards the northern states of Mexico and the United States (Verheecke, 2010). In the 2010 floods in Pakistan, in addition to the heavy death toll, almost 17 million acres of farmland have been flooded and billions of dollars' worth of crops and livestock destroyed. This destruction is particularly significant in a country where two-thirds of the 180 million inhabitants are in agriculture-related work (Karamat, 2010).

Climate change is also expected to reduce workers' productivity by increasing mortality and morbidity because of the resurgence and proliferation of certain diseases and to worsen the working conditions of workers who carry out their activity outdoors, such as construction workers, for example, because of rising temperatures. Increases in respiratory and/or water- and food-related diseases and the risk of malnutrition will also negatively affect employment. The latter will also condition the future incorporation of young workers into the workforce due to irreparable childhood health damage (WHO, 2009). Increased migration and mortality will further aggravate problems such as worker turnover and the loss of qualified workers. The latter issue is of special concern as technical knowledge is essential in order to adapt to changing working conditions.

A detailed description of the potential effects of climate change on employment can be found in Annex I.

In order to shed some light on the link between climate change effects and employment, some regional cases are worth examining. In Europe, agriculture, tourism, insurance, forestry, fisheries, infrastructure and energy were identified as highly vulnerable to the direct effects of climate change due to their dependence on regular climate conditions (ETUC, 2006). Table 1 includes some of the potential direct effects of climate change in Europe.

In Africa, climate change will affect agricultural production through increased water stress, reduced farming areas and decreased yield potential. Jobs in the rural areas will be affected, not only through the direct reduction in agricultural production but also through indirect effects in rural economies such as the knock-on effect on the processing sector, private transport services to the cities and non-agriculture-related commerce which depends on the revenues of agriculture (i.e. small shops in rural communities). For example, an increase of only 2°C would make some areas of Uganda unsuitable

for coffee production. In Uganda, the coffee sector is the most important exporter and one of the biggest employers (ILO, 2007).

In Asia, up to 60 per cent of the income of rural households depends on agriculture, with the rest coming from wage jobs in the same sector. Thus, rises in the frequency of floods or decreases in freshwater availability are likely to affect the two main sources of income of these households. The development of the Asian region will be subject to an increased water stress. Predictions reveal that by 2050 up to 1 billion people will be affected (UNEP, 2007).

In Latin America, the increase in extreme weather events in cyclone-prone zones might bring about changes in tourism patterns in the Caribbean region. For example, the Guatemalan travel and tourism economy accounted for 7.2 per cent of the country's GDP and provided 257,000 jobs in 2007 (6.3 per cent of total employment) (UNEP and Sustainlabour, 2008). In the medium term, these jobs could be at risk.

**Table 1. Potential direct effects of climate change on economic activity and employment in Europe**

Geographical location	Main climatic drivers	Expected effects on economic activity and employment	Level of confidence
Mid- and high latitude regions	Rising temperature, high atmospheric CO <sub>2</sub> concentration	Positive impact on agricultural productivity. Positive impact on employment overall.	Medium/High
Southern Europe	Rising temperature	Negative impact on livestock productivity and employment.	Low
Mediterranean regions	Higher fire risk due to rising temperature and droughts	Negative impact on forestry productivity and employment.	Medium
General	Increase in frequency and intensity of extreme weather events	Negative impact on agricultural and forestry productivity, and employment.	Medium/Low
Fisheries communities (Iceland, Baltic Sea, Spanish and Portuguese coast notably)	Changes in sea surface temperature, wind regime, water runoff, ice melt, or marine currents	Mix of negative and positive impacts on fisheries productivity and employment depending on the region. Shifts in maritime industries, e.g. in the Arctic.	Low

Source: ETUC (2006).

## The employment aspects of climate change adaptation

Can measures aimed at protecting populations from climate change protect workers from the job losses described above? Adaptation strategies, by improving societies' and economies' capacity to react and adapt to climate change, should not in essence have a negative impact on employment.

Generally speaking, there are two kinds of adaptation policies in terms of their positive effects on employment: policies that *avoid job losses* by changing the element in production affected by climate change (i.e. changing crops); and policies that *create jobs* by preparing the country for climate change, engaging in labour-intensive projects (i.e. large infrastructure projects).

For example, in the agriculture and forestry sectors, in which climate change is expected to reduce yields and damage crops, erode soils and increase livestock deaths, adaptation policies need to focus on expanding non-farming activities and farming crops that are able to face greater variability in weather conditions. In the tourism sector, the vulnerability of workers can be reduced through policies that focus on the development of different tourist activities or the promotion of economic diversification. These policies will reduce the negative impacts of climate change on this economic activity and the employment opportunities it generates.

Having said that, it is fair to note that policies aimed at adaptation to climate change in different productive sectors need to take into account the labour-intensity of the output product that is being substituted, in order to avoid conflicts between workers' short-term income needs and mid- to long-term policies (ILO, 2007). If the implementation of policies substitutes a product by another because it is more economically and environmentally viable, as well as less labour-intensive, then policy makers should acknowledge the potential job losses and its impacts on the local economy.

This was made clear in an example on rice substitution in Bangladesh (ILO, 2007). In this case, policy-makers should take into account the employment consequences of substituting rice or fisheries by another agricultural product that is more economically and environmentally viable but requires less labour for its production. What is needed is a set of transitional measures for workers affected by the change in production, designed with the participation of workers and their representatives, and adopted at the very beginning of any adaptation measure.

Vulnerability to climate change is a direct consequence of poverty. Poor people have few resources to plan and implement adaptation strategies to deal with the changes that will occur in their workplaces (notably in the informal economy), in their homes (often in slums or extremely precarious housing) or within their families (for instance with regard to the health effects of climate change). Adaptation policies can start a virtuous circle driving local jobs creation which, with decent wages, can increase workers' wealth, and by doing so, reduce their vulnerability. This virtuous circle is starting to be explored by United Nations agencies, such as the ILO and FAO (ILO, FAO, WHO and UNIFEM, 2009), but it has been rarely mentioned in the UNFCCC negotiations, where the major decisions on adaptation planning practices are made.

Adaptation could also provide positive opportunities for sectors at risk and might even help to improve workers' education and income. Lesotho's National Adaptation Action Plan (NAPA) on Climate Change illustrates this well (Lesotho Meteorological Services, 2007). In the latter, all adaptation measures are expected to be analysed according to their impact on employment and on poverty reduction, and the country planned to choose those with positive outcomes in these two areas. However, Huq and Hugé (in this

issue) show that employment and the involvement of actors in affected economic sectors are not often taken into account in NAPAs.

New jobs will also be created in the construction sector as a consequence of infrastructure investments, such as the building of coastal defences, flood protection, drainage containment, road adaptation, etc. Buildings, infrastructure and homes will have to be better adapted to climate change, and political decisions that promote these strategies will lead to new job opportunities.

Annex II presents a set of adaptation measures and their impacts on employment, and focuses on the sectors that are most at risk and where adaptation is most important. It indicates that adaptation measures can result in some positive effects on employment, or, at least, reduce the negative employment impacts of climate change.

### The effects of mitigation on employment

Adaptation efforts such as those mentioned above will encounter serious difficulties in the future if ambitious measures to reduce the amount of greenhouse gas emissions in the atmosphere are not taken. This is because a rise of GHG in the atmosphere above 450–550 ppm will cause irreversible damage to ecosystems and human lives (Meehl et al., 2007, p. 826).

This section reveals that many economic sectors will face important challenges during their transformation. However, job losses are not an automatic consequence of climate policies, but the consequence of a lack of investment, social policies and anticipation. On a more positive note, this section also compiles a certain number of sources that demonstrate that mitigation measures can indeed have positive impacts on employment, by creating new sectors and new activities in sectors affected by the targeted GHG emission reductions. Annex III describes in detail the impacts outlined in this section for more economic sectors.

### Climate change mitigation is not all good news: The potential challenges arising from emission reduction policies

Efforts aimed at reducing GHG emissions will have negative effects on some economic sectors. Sectors linked to fossil fuel energy and other energy-intensive ones will be profoundly modified by emissions reduction policies. The former include industries such as steel, iron, aluminium but also energy-intensive services such as road transport.

A study on green jobs (UNEP, ILO, IOE and ITUC, 2008a) identifies four impacts of climate change on labour markets. One is explored in the next section and relates to *job creation* opportunities arising from climate policies. The other three ways are:

- *Job substitution*, including changes within sectors, where employment will shift from fossil fuels to renewables. This is well illustrated in the study presented by Miguel Esteban in this issue, which highlights the opportunities for workers in the offshore oil industry who could be re-employed in the offshore renewable industry. Hebe Barber indicates a dynamic of substitution. She describes the consequences of mitigation policies (in this case the promotion of agro fuels in Argentina) as a substitution of a relatively labour-intensive agricultural commodity, citrus, by a less labour-intensive and more land-extensive agriculture commodity, soybean (Verheecke, 2010).
- *Job elimination*, which would imply changes across sectors because there will be no direct replacement for certain jobs. This dynamic is well described in the ETUC research. As an example, job losses are expected in the European coal sector and the oil refining industry. Significant employment consequences are expected in coal mining from the closure of coal plants (ETUC, 2006). Panneels described those impacts (Verheecke, 2010).
- And the most common one: *transformation and redefinition of existing jobs* such as those experienced in industrial sectors which provide materials for cleaner technologies, or service jobs which are oriented towards energy or resource savings.

Gabriela Miranda raises an additional effect: *job displacement* as a consequence of carbon leakage (or the displacement of investments towards territories with less stringent environmental standards) (Verheecke, 2010).

Other possible negative impacts relate to changes in trade regulations which might have impacts in export-oriented sectors. While no trade barriers have been erected on climate grounds, increased awareness by consumers in developed countries might lead to changes in consumption patterns and thus to changes in developing countries' labour markets. A partial example (as the market reduction is not only due to a drop in consumer demand but also to the global recession) is that of around 1,200 jobs lost as a result of the decline in Kenyan flower exports to Europe, a sector which represents 23 per cent of Kenya's GDP (Global Changes, 2009).

However, changes in labour markets arising from the implementation of mitigation policies need to be understood across two fundamental variables: time and space. First, changes will not necessarily happen at the same time in the short term. If climate policies are ambitious enough and put in place in a relatively short period of time, most of the labour market changes are to be expected in the medium run. Second, changes will not be equally distributed geographically, but will likely be concentrated in certain regions.

Time and space gaps also apply to the opportunities offered by mitigation, and they make imperative the introduction of social stabilizers adapted to the magnitude and scope of the transition expected if we are to achieve a

low-carbon and climate-resilient society in a generation's time. These transitional measures, regrouped under the concept of "Just Transition", are defined and exemplified below.

Finally, it is important to note that the sectors which might be affected by climate regulations and actions are not evolving in a vacuum. Many of them are also facing other challenges. This is the case in certain fossil fuel-based energies, in which the ratio of job/KW has decreased as a consequence of an increase in the capital intensity in the sector. Coal, for instance, even across a wide range of different labour intensity figures, has seen its employment factor decrease and is projected to employ fewer people, independently from renewable energy development (IEA, 2009, p. 21).

For other sectors, rising automation, restructuring and outsourcing have had more substantial impacts than environmental regulations (OECD, 2010a). The decline of some industrial regions needs to be attributed to the globalization of production, technological change, footloose industries and productivity changes that led to structural changes with substantial declines in jobs and inhabitants (Martinez-Fernandez in OECD, 2010a). This is not to say that concerns about employment consequences of climate change policies should be ignored. On the contrary, this information helps to understand the hardship these communities are already facing and the fear that climate policies might add a burden to an already difficult situation.

Industries have tended to make labour pay the cost of their lack of investment in research and development. In their race to reduce production costs, industries have closed factories and looked for cheaper workforce elsewhere without necessarily investing in sustainability to modify the CO<sub>2</sub> patterns in their sector of activity. The transition towards a low-carbon economy must therefore enshrine respect for the livelihoods of workers and their communities and the need for different corporate behaviour.

**Table 2. Employment factor for coal production and employment**

	Employment factor (existing generation) <i>Jobs per GWh</i>	Employment factor (new generation) <i>Jobs per GWh</i>
World average	0.4	0.25
OECD North America	0.03	0.02
OECD Europe	0.36	0.17
OECD Pacific	0.05	0.02
India	0.59	0.25
China	0.52	0.02
Africa	0.11	0.07
Transition economies	0.46	0.19
Developing Asia	Use world average as no employment data available	
Latin America	Use world average as no employment data available	
Middle East	Use world average as no employment data available	

Source: Greenpeace and EREC (2010).

## Will climate policies drive decent employment creation?

In the last few years, several policy-makers, advocacy groups and researchers have debated around the “green job creation” potential of climate policies, in particular mitigation.

When the positive aspects of mitigation policies for employment are discussed, an argument put forward by researchers is the labour intensity of low-carbon options in the energy efficiency, power generation and transport sector, vis-à-vis their high-carbon and currently used alternatives (Kammen, Kapadia and Fripp, 2004).

The International Energy Agency (IEA), for example, indicated that in the framework of economic recovery policies, energy efficiency, smart-metering and development of renewable energies created more jobs in the short term than traditional energy sources (IEA, 2009).

As table 3 demonstrates, even when a decrease in labour intensity over time is taken into account (as a consequence of the tendency to increase the ratio of capital over labour with the progress of a certain technology), clean technologies and processes keep their labour intensity-potential (Greenpeace and EREC, 2009 and 2010).

Only one global assessment (UNEP, ILO, IOE and ITUC, 2008a) and one macroeconomic study for more than one country, the European Union (ETUC, 2006), have been published in this area. While both are cautious regarding the net employment impacts of “green” policies, both coincide on the important potential for job creation in a certain number of sectors. This is confirmed by an important body of research focusing either on one sector, or on a specific country.

Notably, Pollin and Wicks-Lim (2008) show how an ambitious mitigation framework would generate employment across a certain number of

**Table 3. Employment factors by energy source**

Fuel	Construction, manufacturing and installation Person years/MW	Operation and maintenance Jobs/MW	Fuel Jobs/GWh
Coal	7.7	0.1	Regional factors
Gas	1.5	0.05	0.12
Nuclear	16.0	0.3	0.001
Biomass	4.3	3.1	0.2
Hydro	11.3	0.2	
Wind	15.0	0.4	
PV	38.4	0.4	
Geothermal	6.4	0.7	
Solar Thermal	10.0	0.3	
Ocean	10.0	0.3	
Multiplier for CHP		1.3	

Source: Greenpeace and EREC (2010).



sectors. Equally, studies concentrating on certain sectors shed light on the potential positive consequences of mitigation policies.<sup>4</sup>

The French Agency for the Environment and Energy Management (ADEME) estimates the number of direct jobs in the energy efficiency, renewable energy and public transport infrastructure at 260,000 FTE, a level equivalent to the chemical industry and with a growth rate of 27 per cent compared with 2006 and 13 per cent compared with 2007 (ADEME, 2009).

In Brazil, current accounting of employment in environmentally friendly sectors also shows the positive effects of green policies.

In 2008, the number of employees in companies listed as performing green economic activities reached 1,405,001. This amount represents 3.6 per cent of the total formal employment generated by the Brazilian economy in that year. Between 2006 and 2008, employment in green economic activities grew at an annual rate of 7.9 per cent. At the same time, employment in economic activities producing oils based on renewable resources grew at an annual rate of 15.7 per cent (Caruso, 2010).

When these trends are studied from a sectoral perspective, opportunities are also found.

Regarding *energy efficiency*, while numbers at the global and economy-wide levels are not available, there is a general consensus around the idea that measures promoting energy efficiency create jobs in auditing and other energy services. The auditing and evaluation of energy consumption, the analysis of reduction opportunities for industrial and commercial facilities as well as households, are initial activities from which important sources of employment could emerge in the future.

Energy efficiency measures also create opportunities in the building sector. Nevertheless, this sector (a particularly labour-intensive one) faces the challenge of improving job quality, which remains very low.

Several studies estimate that every US\$1 million invested in building efficiency retrofits creates 10–14 direct jobs and 3–4 indirect jobs (Hendricks, Campbell and Goddard, 2009). If the positive impacts on employment of retrofitting building were better known, these policies could be promoted as part of a job creation agenda with emission reductions and households' reduced energy consumption as environmental co-benefits.

For instance, one of the aspects of the Brazilian programme "My house, my life" has facilitated poor households' access to solar panels. According to estimations between 2009 and 2010, as a consequence of this programme,

---

4. In addition to the examples mentioned below, other national case studies are available. For Australia, see: Australian Conservation Foundation (ACF) and Australian Council of Trade Unions (ACTU): *Creating jobs – Cutting pollution, the roadmap for a cleaner stronger economy*, 2010.

around 800 project managers and 7,000 installers of solar panels will be employed (Caruso, 2010).

The expansion of *renewable energies* such as solar, wind, geothermal and agroenergy will have a positive impact on employment. The manufacture, installation and maintenance of solar panels should create in the entire world 6.3 million jobs by 2030, while wind power should create more than 2 million jobs (UNEP, ILO, IOE and ITUC, 2008a). The IEA estimates that for every billion dollars invested in clean energy technology, 30,000 new jobs will be created (IEA, 2009). Kammen, Kapadia and Fripp (2004) reveal that the renewable energy sector generates more jobs than the fossil fuel-based energy sector per unit of energy delivered.

However, labour shortages for this key area have already been identified. They would probably disappear if ambitious training and education programmes were put in place. The CEDEFOP states that:

Understanding the environmental impact of an occupation needs to be mainstreamed into education and training systems. Integrating sustainable development and environmental issues into existing qualifications is much more effective than creating new training standards. Every new apprenticeship ought to have a low-carbon element (CEDEFOP, 2010).

If these deficiencies are addressed, there is a huge employment potential in the renewables sector. The latest data available for Spain, for example, show that the wind sector alone has created 95,000 new jobs (24,000 direct jobs and 71,000 indirect jobs) driven by the domestic component associated with the design, production and assembling processes (Sanchez Lopez, 2006).

Given the increasing interest in energy alternatives, 2.1 million jobs will be created in wind energy production, 6.3 million in solar photovoltaic and 12 million in biofuels-related agriculture and industry by 2030 (UNEP, ILO, IOE and ITUC, 2008a). In the case of agroenergies, it is clear that the number of jobs created is already very high. A study of Brazil identifies several reasons why ethanol production is a huge opportunity for job creation (IAEA, 2006). We should, however, give greater importance to analysing working conditions and overall environmental and food production impacts ahead of their promotion. Agrofuels will probably worsen the already problematic working conditions in agriculture.

In the *transport* sector, mitigation measures could lead to the creation of an important number of jobs. Rail transportation, for both freight and passengers, should be a source of well-trained and safe jobs. In the United States, a billion dollars spent on public transport generates (averaging between operations and capital projects) around 36,000 jobs, which is 9 per cent and 17 per cent higher than the job creation potential from road maintenance and new roadway projects respectively (Litman, 2009; see also table 4).

**Table 4. Economic impacts per US\$1 million expenditures**

Expense category	Value added 2006 dollars	Employment FTEs*	Compensation 2006 dollars
Auto fuel	1,139,110	12.8	516,438
Other vehicle expenses	1,088,845	13.7	600,082
Household bundles			
<i>Including auto expenses</i>	1,278,440	17.0	625,533
<i>Redistributed auto expenses</i>	1,292,362	17.3	627,465
Public transit	1,815,823	31.3	1,591,993

This table summarizes input-output table analysis. In 2006, a million dollars shifted from fuel expenditures to a typical bundle of consumer goods adds 4.5 jobs to the US economy, and each million shifted from general motor vehicle expenditures adds about 3.6 jobs.

(\* FTE = Full-Time Equivalent employees).

Source: Litman (2009).

When the employment dimension of climate change is analysed, it becomes clear that major changes in the labour market are to be expected. Far from being smooth, those changes can be experienced by workers and their families as extremely disruptive.

This is the case because, as we have explained before:

- There are important gaps in terms of time and geographic impacts that need to be addressed.
- Without proactive regulatory action, the costs of policies will be unevenly distributed among citizens (there is a risk for poor workers and households to be the ones that pay the most), which could generate a feeling of unfairness and act as a social barrier in the implementation of climate policies.
- Labour shifts within and across sectors cannot occur automatically and there is a risk for environmental policies not to achieve their outcomes because of a lack of workforce availability (i.e. due to a lack of training, lack of awareness on job opportunities, absence of available workforce in certain regions, etc.)

The following section will explore policy options that have been put forward in order to address those changes and shifts in a socially acceptable manner.

### **A public policy framework for accompanying labour markets: Just Transition**

Climate change and policies aimed to adapt to it or to reduce greenhouse gas emissions will have impacts on labour markets. Those impacts might be considered positive (such as employment creation in infrastructure projects linked to adaptation or renewable energy development) or negative (such as the impacts of climate change on agricultural workers or in energy-intensive

sectors). Nonetheless, this section shows that the employment outcomes of climate change policies vary according to their process of implementation.

This reasoning is the basis of the “Just Transition” strategy which originated in the trade union movement and which has now been adopted by other community and NGO groups, UN agencies and governments, among others.

This section will explore the origins of the concept, but most importantly, its evolution, which turned it into an instrument for workers and communities to claim and ensure attention for their transitional needs in the transformations towards a low-carbon and climate-resilient society.

### Definition and evolution of the Just Transition concept

In 1998, a Canadian union activist, Brian Kohler, published what was going to become one of the first mentions of the Just Transition concept in a union newsletter (Kohler, 1998). It constituted an attempt to reconcile the union movement’s efforts to provide workers with decent jobs and the need to protect the environment. As Kohler had clearly stated previously: “The real choice is not jobs or environment. It is both or neither.” (Kohler, 1996).

In ten years, the union movement perception of environmental challenges has evolved and with it the definition, boundaries and scope of the “just transition” needed.<sup>5</sup> Today, “Just Transition” can be understood as the conceptual framework in which the labour movement captures the complexities of the transition towards a low-carbon and climate-resilient economy, highlighting public policy needs and aiming to maximize benefits and minimize hardships for workers and their communities in this transformation.

In a document prepared by the International Trade Union Confederation (ITUC), Just Transition is defined as a “tool the trade union movement shares with the international community, aimed at smoothing the shift towards a more sustainable society and providing hope for the capacity of a green economy to sustain decent jobs and livelihoods for all” (ITUC, 2009b).

It is important to note that Just Transition is a supporting mechanism of climate action, and not inaction. Just Transition is not in opposition to, but complements environmental policies. This comforts the idea that environmental and social policies are not contradictory but, on the contrary, can reinforce each other.

This approach to the Just Transition concept was unanimously adopted at the 2nd ITUC Congress, in 2010, when the Congress declared “Just Transition” to be “the” approach to fight climate change:

5. Early mentions of Just Transition can also be found in ICFTU: *‘Plough to Plate’ Approaches to Food and Agriculture*, 2000; ICFTU: *Fashioning A New Deal – Workers and Trade Unions at the World Summit for Sustainable Development*, 2002.

Congress is committed to promoting an integrated approach to sustainable development through a just transition where social progress, environmental protection and economic needs are brought into a framework of democratic governance, where labour and other human rights are respected and gender equality achieved (ITUC, 2010).

Other Global Union Federations, representing workers in specific economic sectors, joined this policy approach. The International Transport workers' Federation (ITF) adopted, at its 2010 Congress, a resolution stating that "while the urgent adoption of these policies is vital to tackle climate change, the ITF and its affiliates must defend the interests of transport workers by fighting to ensure that these policies are implemented in a way which protects jobs and creates new ones through a process of just transition" (ITF, 2010). Federations of industrial workers have also voiced their positions on Just Transition. The International Federation of Chemical, Energy, Mine and General Workers' Unions (ICEM), for example, states that "with a Just Transition, we can build a public consensus to move towards more sustainable production" (ICEM, 2009).

The Just Transition framework is a package of policy proposals which addresses the different aspects related to the vulnerability of workers and their communities: uncertainties regarding job impacts, risks of job losses, risks of undemocratic decision-making processes, risks of regional or local economic downturn, among others.

A Just Transition framework needs to incorporate, at least, the policies detailed below:

### *Sound investments in low-emission and labour-intensive technologies and sectors*

Climate-friendly investments are positive in terms of employment creation. However, without a massive shift in investments towards these sectors, those opportunities will not be realized, hindering progress on climate policies. Workers from declining sectors or young workers who have not yet entered the labour market need job alternatives, and green investments can provide them. These investments could be driven, in the initial phase, by public sector policies, including procurement, infrastructure projects and public regulations.

Some of these investments have been promoted as suitable for "recovery packages" in the context of the economic crisis (OECD, 2010b).

### *Research and early assessment of social and employment impacts*

Those conditions are crucial to better prepare for change. As stated by the ITUC, “a proper consultation process will not be sufficient unless it is accompanied by relevant studies assessing the impacts of alternative emission reduction scenarios on production systems. Systematic country, region and sector-specific studies on climate change policies and their impacts on employment and labour markets must be carried out. Ex ante analysis of policies is key, as this enables their redesign and improvement” (ITUC, 2009c, p. 15).

An initiative to start addressing those gaps was taken by the ITUC, the Global Unions Research Network (GURN) and the ILO Bureau for Workers’ Activities (Verheecke, 2010).

The aspects which still need to be explored, in order to prepare social actors to the transformation our societies are going to face, are examined in the next section, which specifically addresses research gaps.

### *Social dialogue and democratic consultation of social partners and stakeholders*

Governments have to consult with and encourage institutionalized and formal involvement of trade unions, employers, communities, and all other relevant community groups. Consultation and respect for human and labour rights form the baseline conditions for a smooth and effective transition towards a sustainable society.

Social dialogue is a tool used to promote consensus-building and the democratic involvement of the main stakeholders in the world of work. Successful social dialogue structures and processes have the potential to resolve important economic and social issues, to encourage good governance, to advance social and industrial peace and stability and to boost economic progress (UNEP and Sustainlabour, 2008, pp. 89–90).

Studies confirm the value of tripartite social dialogue in the context of climate change. An ILO report which studied a unique experience of tripartism adapted to climate change discussions in Spain highlighted this potential: “Tripartite social dialogue [is] a valid instrument in the analysis of the effects on competitiveness, employment and social cohesion in policies related to climate change”. The report found that the experience was considered positive for information and consensus-building, a driver for internal actions in each sector, and potentially useful for monitoring progress (ILO and Sustainlabour, 2010).

### *Training and skills development*

Changes on the ground require workers to be trained in clean processes and technologies. This is key to absorb and develop new technologies and to realize the potential of green investments. Educational leave for workers to acquire new skills might be needed. Many organizations agree on this aspect of the “Just Transition” framework. In addition to the ILO (CEDEFOP and ILO, 2010), UNEP (UNEP, ILO, IOE and ITUC, 2008a) and the OECD (OECD, 2010b), other organizations such as UNCTAD highlighted the importance of skills development: “The key elements of a favourable environment for cross-border flows of low-carbon technology include availability of the requisite skills” (UNCTAD, 2010, p. 31). More references on the need for skills development are available in the section on employment aspects of mitigation.

### *Social protection*

Vulnerability may be a source of reluctance to support change. Social protection schemes, including active labour market policies (social security including social insurance and public employment guarantee schemes, job-creating public works programmes for the unemployed and working poor, income maintenance and job placement services, among others) are key to ensure justice during the transition. A certain number of policies will need to be promoted to avert or minimize job losses, to provide income support and to improve the employability of workers in sensitive sectors.

Social protection also needs to address the consequences of climate change and extreme weather events on the poorest and the most vulnerable. Unfortunately, insufficient attention has been played in the social protection sphere to the long-term risks posed by climate change. However, social protection approaches could inform disaster risk reduction and climate change adaptation based on established implementation frameworks for vulnerability reduction” (IDS, 2007, p. 1).

### *Local analysis and economic diversification plans*

Each region and community at the receiving end of positive or negative employment effects of climate change policies needs its economic diversification plan. Communities cannot be abandoned to situations of ultimate rescue as they never lead to a fair distribution of costs and benefits.

As has been previously highlighted, the impacts of climate change on employment mask local disparities. Although no region will be left unaffected, the effects of climate change are unlikely to be uniform across regions. And the OECD to point out: “the paradox is that while local governments play a

relatively marginal role in designing and implementing climate change regulation, they will play a considerable role in managing transition to a low-carbon economy and enabling green growth” (OECD, 2010b, p. 28).

## Diversifying Just Transition strategies

The elements described in the section above, while broad and general, represent an ambitious framework, as it covers a broad variety of measures without questioning the scope of the environmental challenges ahead. Although all those policy options have been tested and proved successful in various contexts, not a single country has yet organized a massive transformation as the one the Just Transition framework calls for.

We consider that while ambitious, the framework should be built upon. The complex reality that different countries and regions are going to face in their transitions to a low-carbon and climate-resilient economy requires the Just Transition concept to be developed taking into account at least three different starting points and consequent policy options:

### *Carbon-intensive developed countries*

These countries are resource-intensive and relatively wealthy. Their per capita consumption rates would exceed the planet’s ecological limits if they were reproduced globally. In their case, a deep transformation of production and consumption patterns is needed. The movement towards highly efficient and low-carbon patterns is to be carried out without harming the prosperity of all their inhabitants.

This is the “transition” that has inspired the concept. Emerging evidence focuses on issues such as the means by which certain sectors will adapt to climate regulations, the impacts climate change will have on labour markets and which measures to apply to “smooth” the transition and share its related costs and benefits fairly.

Most of the countries in this group are facing a severe economic crisis, with high unemployment rates. This context has prompted some of them to consider “green recovery” policies, even if these have not been maintained for a sufficient amount of time to drive major changes. This group of countries have also put in place in the last decades a certain number of provisions to cushion the negative effects of changes in labour markets on workers (unemployment benefits, training and skills development, job placement services).

All policies described in the previous section seem relevant to this group which has “inspired” the Just Transition idea. However, several challenges in the implementation of the idea remain: high public debt and recent slowdown in government-led stimulus packages, reduced use of social dialogue



and partnership with trade unions, intense lobbying by enterprises established in carbon-intensive sectors. Table 5 compiles a list of policies for the transitional scenario of this group.

**Table 5. Carbon-intensive developed countries<sup>a</sup>**

	GHG per capita (tons of CO <sub>2</sub> eq.) <sup>b</sup>	CO <sub>2</sub> Cumulative emissions (% world) <sup>c</sup>	GDP per capita (US\$) <sup>a</sup>	Gini coefficient <sup>d</sup>	Unemployment rate (%) <sup>e</sup>
Average	10.5	8.44	36'952	34.48	9.02
Max.	25.0	29.30	32'451	40.80	20.05
Min.	9.0	0.90	45'590	24.90	5.10

*Driving investments*

- Putting a price to GDG emissions through regulations
- Incorporate “green investments” into recovery plans
- Mainstream climate change needs in public procurement
- Develop “green” fiscality (incorporating environmental protection while preserving the long term sustainability of the system)
- Reform corporate governance (shift from shareholder to stakeholder-driven decision-making)
- Identify priority regions and use investments to prepare their future

*Social dialogue*

- Adapt social dialogue institutions and use them for climate change decision-making
- Consider developing tripartite dialogue at the sectoral and territorial level for planning the transition
- Promote multi-stakeholder platforms

*Skills and training*

- Update training schemes to incorporate “green economy” needs
- Mainstream lifelong learning in workers’ careers
- Upscale the profile of technical careers

*Social protection*

- Develop protection schemes adapted to scattered careers
- Accompanying workers and SMEs in declining sectors with programmes of entrepreneurship development, retraining, job placement services support, and other labour market policies

<sup>a</sup> For the purpose of the classification, a country has been considered wealthy when its GDP per capita is above US\$30,000.

<sup>b</sup> See [http://unstats.un.org/unsd/environment/Questionnaires/country\\_snapshots.htm](http://unstats.un.org/unsd/environment/Questionnaires/country_snapshots.htm). Accessed 16 Sep. 2010.

<sup>c</sup> CO<sub>2</sub> from fossil fuels and cement manufacture, 1850–2002, <http://www.wri.org/publication/navigating-the-numbers>. Accessed 16 Sep. 2010.

<sup>d</sup> See <http://hdrstats.undp.org/en/indicators/161.html>. Accessed 16 Sep. 2010.

<sup>e</sup> See [http://en.wikipedia.org/wiki/list\\_of\\_countries\\_by\\_unemployment\\_rate](http://en.wikipedia.org/wiki/list_of_countries_by_unemployment_rate). Accessed 16 Sep. 2010.

### *Increasingly carbon-intensive emerging economies*

With their increased share of international production and trade, emerging economies seem to follow development pathways similar to those of industrialized countries. This development model leaves social inequalities and environmental protection to be addressed at a later stage, once sufficient wealth has been created. This idea, which might have worked for industrialized countries, seems difficult to realize now. Several environmental challenges

are reaching their tipping points and social unrest is increasing. People might not wait generations for the distribution of wealth to occur. A Just Transition strategy in these countries implies an earlier and different implementation of environmental policies than that of developed countries.

It would include a better integration of environmental and fairness concerns in development planning, the promotion of an original economic model and the development of innovative social protection schemes. The impacts of the transition of emerging economies towards a more environmentally and people- friendly model have rarely been studied. Will a different model delay or advance social progress? In order to respond in a sound manner to this question, further research is necessary, especially on the proposals listed in table 6.

**Table 6. Increasingly carbon-intensive emerging economies<sup>a</sup>**

	GHG per capita (tons of CO <sub>2</sub> eq.) <sup>b</sup>	CO <sub>2</sub> Cumulative emissions (% world) <sup>c</sup>	GDP per capita (US\$) <sup>a</sup>	Gini coefficient <sup>d</sup>	Unemployment rate (%) <sup>e</sup>
Average	6.5	1.9	7134	42.84	9.9
Max.	15.0	8.1	19'841	57.80	25.3
Min.	1.0	0.2	976	31.60	3.7

#### *Investments*

- Incorporate climate change in national planning
- Link poverty reduction/job creation to mitigation-friendly investments
- Develop fiscal policies which promote companies' and wealthy households' resource efficiency
- Develop sustainable investment framework for SMEs, which includes decent work provision along with environmental standards
- Develop a sustainable investment framework for MNEs
- Make use of national banks for driving changes in specific sectors

#### *Social dialogue*

- Ensure respect of core labour standards
- Adapt social dialogue institutions and use them for climate change decision-making
- Consider developing tripartite dialogue at the sectoral and territorial level for planning the transition
- Promote multi-stakeholder platforms

#### *Training and skills*

- Develop skills partnerships with employers
- Develop regional development strategies focusing on specific green options
- Mainstream social progress/environmental protection in universities' curricula
- Develop skills programmes in local "social" centres for poor workers

#### *Social protection*

- Reinforce initiatives towards formalization of the workforce/decent work provision
- Develop innovative safety nets
- Scale up access to education

<sup>a</sup> For the purpose of the classification, a country has been considered wealthy when its GDP per capita is between US\$900 and US\$20,000.

<sup>b</sup> See [http://unstats.un.org/unsd/environment/Questionnaires/country\\_snapshots.htm](http://unstats.un.org/unsd/environment/Questionnaires/country_snapshots.htm). Accessed 16 Sep. 2010.

<sup>c</sup> CO<sub>2</sub> from fossil fuels and cement manufacture, 1850–2002, <http://www.wri.org/publication/navigating-the-numbers>. Accessed 16 Sep. 2010.

<sup>d</sup> See <http://hdrstats.undp.org/en/indicators/161.html>. Accessed 16 Sep. 2010.

<sup>e</sup> See [http://en.wikipedia.org/wiki/list\\_of\\_countries\\_by\\_unemployment\\_rate](http://en.wikipedia.org/wiki/list_of_countries_by_unemployment_rate). Accessed 16 Sep. 2010.

## Low-carbon, highly climate-vulnerable developing countries

The capacity of developing countries to deliver a Just Transition programme is modest. However, there is a need to ensure that people's resilience is at the centre of their development strategies. Exploring the means to mainstream climate change in development aid, to expand democratic decision-making on these issues, to fight unemployment, informal work and corruption, among others, seems fundamental. A Just Transition strategy in these countries also requires respecting trade union rights to ensure that workers' voices are heard during the transition (see table 7).

**Table 7. Low-carbon, highly climate-vulnerable developing countries<sup>a</sup>**

	GHG per capita (tons of CO <sub>2</sub> eq.) <sup>b</sup>	CO <sub>2</sub> Cumulative emissions (% world) <sup>c</sup>	GDP per capita (US\$) <sup>a</sup>	Gini coefficient <sup>d</sup>	Unemployment rate (%) <sup>e</sup>
Average	1'075	n.d.	507.75	51.1	45.8
Max.	2.4	n.d.	762.00	64.3	95.0
Min.	0	n.d.	159.00	39.0	20.0

### *Investments*

- Mainstream climate change in ODA
- Redirect remittances to low-carbon, climate-resilient investments
- Identify regional priorities and ensure coherence among different development actors on the ground
- Develop fiscal policies
- Verify climate resilience of infrastructure investments
- Social dialogue
- Ensure core labour standards implementation, human rights enforcement and democracy
- Increase awareness of social partners on sustainability issues, including through the media
- Promote tripartism for identifying vulnerability of workplaces and possible solutions

### *Training and skills*

- Promote better access to education
- Incorporate domestic content provision in foreign direct investment on clean technologies
- Use UNFCCC mechanisms for capacity building

### *Social protection*

- Work towards the reduction of informal work and decent work promotion
- Work towards the creation of social protection schemes (health services, education, and unemployment services)

<sup>a</sup> For the purpose of the classification, a country has been considered wealthy when its GDP per capita is below US\$900.

<sup>b</sup> See [http://unstats.un.org/unsd/environment/Questionnaires/country\\_snapshots.htm](http://unstats.un.org/unsd/environment/Questionnaires/country_snapshots.htm). Accessed 16 Sep. 2010.

<sup>c</sup> CO<sub>2</sub> from fossil fuels and cement manufacture, 1850–2002, <http://www.wri.org/publication/navigating-the-numbers>. Accessed 16 Sep. 2010.

<sup>d</sup> See <http://hdrstats.undp.org/en/indicators/161.html>. Accessed 16 Sep. 2010.

<sup>e</sup> See [http://en.wikipedia.org/wiki/list\\_of\\_countries\\_by\\_unemployment\\_rate](http://en.wikipedia.org/wiki/list_of_countries_by_unemployment_rate). Accessed 16 Sep. 2010.

## Research gaps

The previous sections make it clear that research is progressing on a certain number of employment-related aspects of climate change. However, by identifying new policies which could be promoted in the framework of a Just Transition, it also opens new areas to be explored. This paper, along with discussions that took place in 2010 (Verheecke, 2010), reveals numerous research gaps. Filling them is fundamental for social actors to be armed for defending solid, socially acceptable climate policies. This section will describe those gaps and explain why filling them is vital to gain a better understanding of the dynamics of labour markets and climate change.

## The geographical gap

Available research has tended to focus on the macroeconomic aspects of mitigation measures in the countries where mitigation has been discussed for several years, namely industrialized countries. Among them, only a minority has dealt with employment. Today, this is not only a barrier to engaging in constructive dialogue on mitigation actions in emerging economies but also an obstacle to knowledge on the impacts of climate change mitigation or adaptation in the three groups of countries.

What could be the impacts of emission reductions in energy-intensive sectors in countries like Brazil, China or Indonesia? What would “reduced emissions from deforestation and forest degradation” (REDD) imply for jobs in the forestry sector? From an employment perspective, is there any difference between climate-resilient infrastructure projects and traditional public works plans? These and other questions remain unanswered due to a lack of available research.

In addition, the lack of geographical analysis masks the different impacts on intra-country disparities, such as income inequalities or social protection schemes. Several studies suggest that the economic impacts of climate measures can be considered small compared to a country’s GDP. However, others show that the impacts are often concentrated in a certain sector of the population or in a particular geographical space. The way in which these groups will be able to adapt to a different situation will vary and policy frameworks should thus be developed accordingly.

## The sectoral gap

Economic research on the impacts of climate change and climate change policies within sectors is also missing. As revealed in the previous section, a number of sectors will be affected by climate policies. Some due to the

impacts that climate change will have on their output (agriculture, fisheries, tourism), others because of modifications arising from adaptation policies (construction, agriculture, transport) and, finally, some sectors will be transformed as a consequence of emission reduction policies (industry, services, energy production, forestry, etc).

Although some studies have been published on a certain sector in a certain country or region, the amount of research is not sufficient to draw international conclusions or trends on labour markets in those sectors. Some sectors, such as electricity production, have been widely studied. The net effects of a shift towards renewable energies appear positive in terms of employment. However, other aspects of energy generation and distribution are not taken into account in the analyses, highlighting certain biases.

As in the case of geographical gaps, a better understanding of sectoral impacts would help to rebalance the costs and benefits of climate measures and to anticipate more adequately the targeted measures needed for a Just Transition.

### The historical gap

Labour markets have faced several large-scale changes since the beginning of wage labour. Those changes sometimes implied profound transformations and most of the times were unplanned, leading to hardship for working families. There is a need to know if certain historical experiences could provide support to understand the means towards socially fair transformations. Research on past reforms and restructuring processes which have led to unfair and/or unsustainable situations should also be identified in order not to repeat past mistakes.

It is true that the level of transformations required to shift to a low-carbon and climate-resilient economy is probably as great as the one observed during the industrial revolution. It is fundamental to acknowledge that in society's interest, this transformation should be planned as much as possible to reduce social shocks and to use the changes as drivers to transform the other failing elements of our systems.

What elements have been key for workers to accept and support in-depth transformations in a certain sector or region? What was the role of trade unions? What role was played by certain regulations, social dialogue or other labour market regulations? How were the "transitional" systems financed? Were there any voluntary measures set by companies in addition to regulations? The greater the number of experiences gathered, the more the transition will be perceived as fair and will help our societies to achieve prosperity and environmental sustainability.

## The skills gap

As seen in the previous section, the skills development aspects of the transition are studied by a series of actors. If skills are considered as “the best insurance against unemployment and an important factor for personal development and active citizenship” (European Commission, 2009, p. 2), many questions remain unanswered. The discussion on whether the low-carbon economy will imply the development of “old skills in new contexts”, new skills, or a mix of both is mobilizing most of the attention.

Other questions though deserve attention: How many workers will have to acquire new skills in the next 10–15 years? Will the transformation have a differentiated impact on workers, depending on their skills level? How can the transition benefit low-skilled workers? How can skills gaps be filled when there are no public training schemes? What role can social partners play to fill those gaps?

## The decent work gap

The quality of the employment opportunities arising from clean investments still needs to be better studied. It has been said that there is no automatic link between green jobs and decent work (UNEP, ILO, IOE and ITUC, 2008a), but only a few studies on the working conditions in emerging sectors have been pursued.

In addition, a huge gap remains to be filled regarding three fundamental questions: What strategies are available to improve working conditions in new sectors? Are these sectors fundamentally different from other non-organized ones? Can these new sectors drive a transformation of labour markets where decent work is not the rule?

Understanding the way in which a climate-resilient and low-carbon economy will impact and hopefully improve the lives of the most vulnerable workers is also crucial, in particular regarding workers in the informal economy or migrant workers, for instance.

Answers to these questions are central in order to build strategies needed to ensure that the Decent Work Agenda is enshrined in sustainable, low-carbon strategies and that workers reap the benefits of the transition through dignifying working and living conditions.

## The gender/age gap

This is probably one of the most under-studied aspects of labour market dynamics in the context of climate change and climate policies. Only one study is available on the gender impacts of green jobs (Stevens, 2009). No studies

are available on the differentiated impacts of climate policies in terms of age, despite the fact that clearly there are differences in the opportunities and challenges workers face depending on their age and gender.

A recent symposium highlighted some gaps in gender studies in relationship with climate change. However, it did not identify women's employment dynamics as a research gap (GenderCC, 2010). This is surprising when we know that it was found that there is a risk that women will not enjoy the benefits of green jobs development. Stevens found that "the majority of green jobs are expected to be in the construction, manufacturing and engineering fields where women are significantly under-represented". As a result, "the green economy may unintentionally exclude women" (Stevens, 2009, p. 7).

There is also a need to understand if job creation in emerging sectors (as a consequence of mitigation or adaptation policies) will address the rising problem of youth unemployment and what kind of policies can help young workers to meet the needs of future labour markets. This debate is also linked to the need to know if the working conditions of young workers will be decent. Job opportunities in non-organized sectors might imply an access to employment, but not necessarily to decent work.

Although these research gaps are not exhaustive, they identify a very ambitious agenda for researchers, who could, through their proposals, participate in the understanding of social movements of the transformations to be expected, and become active agents of change in the construction of a progressive climate change agenda.

## Conclusion

The way forward seems complex. On the one hand, progress on the climate change agenda (at the UNFCCC, at the national level) is far from having reached the pace necessary to avert dangerous climate change; on the other, a certain number of actors (trade unions, non-governmental organizations, community groups) are now actively lobbying for the inclusion of social aspects (including employment) in climate change decisions.

Certainly, an increase in the amount of research in the areas highlighted in this paper would help the understanding of the employment impacts of climate change and, in so doing, help trade unions, governments and other social actors to build a more consensual, socially friendly and ambitious climate policy.

However, this will not be enough to change the current trajectory of our societies. The origins of environmental and social crises find a common source in the prevailing economic model and, it is fair to say, little or no progress has been made in changing that model. Most of the policies advocated today to protect the climate are aimed at increasing the efficiency in the use

of natural resources rather than changing production and consumption patterns that are environmentally harmful, socially unfair and unsustainable.

Traditional neoliberal recipes seem to be gaining ground in this moment of economic crisis. A diminished role for the State and for public investments, a certain resistance to new regulations, all these contradict the policies which will be necessary to stimulate a low-carbon economy.

This paper has summed up some of the research available on climate change and labour markets, also indicating that the transition will lead us to a better world only if the ultimate outcome of the transformation – the decision about what kind of society we want for present and future generations – as well as the process for getting there are democratically decided and inclusive of the most vulnerable.

Our collective capacity to manage and achieve a Just Transition cannot be taken for granted. Efforts will have to be made by all groups. Only time will tell if we were up to the challenge of anticipating and protecting those who needed protection, or if particular, short-term interests were stronger. For the moment, the time is still with us for putting pressure on leaders and at the grassroots level, making clear that a Just Transition is the best solution in our hands for giving a decent future to our people.

## References

- ACF/ACTU. 2010. *Creating jobs – Cutting pollution, the roadmap for a cleaner stronger economy – Australian Conservation Foundation*, Australian Council of Trade Unions, Australia.
- ADEME. 2009. “Maîtrise de l’énergie et développement des énergies renouvelables: un marché en croissance continue malgré la crise économique”, in *Adème & Vous*, No. 22, 1 Dec.
- Caruso, L. 2010. *Skills for green jobs in Brazil*. Unedited background country study, International Labour Office, Skills and Employability Department (Geneva).
- CEDEFOP. 2010. “Skills for green jobs – Developing a low-carbon economy depends on improving existing skills rather than specialised green skills”, Briefing Note, July.
- ; ILO. 2010. *Skills for green jobs: European Synthesis report*, European Union publication office, available at: <[http://www.ilo.org/wcmsp5/groups/public/--ed\\_emp/--ifp\\_skills/documents/publication/wcms\\_143855.pdf](http://www.ilo.org/wcmsp5/groups/public/--ed_emp/--ifp_skills/documents/publication/wcms_143855.pdf)> [accessed 16 Sep. 2010].
- ETUC. 2006. *Climate Change and Employment: Impact on Employment in the European Union-25 of Climate Change and CO<sub>2</sub> Emission Reduction Measures by 2030* (Brussels).
- European Commission. 2009. *New skills for new jobs: anticipating and matching labour market and skills needs* (Brussels).
- GenderCC. 2010. *Symposium Gender and Climate Change Research: Gaps and Questions*, Germany, June, available at: <<http://www.gendercc.net/policy/meetings.html>> [accessed 10 Sep. 2010].



- Global Changes. 2009. *Kenya's Flowers Diminish*, blog post available at: <<http://www.global-changes.com/kenyas-flowers-diminish/>> [accessed 16 Sep. 2010].
- Global Footprint Network. 2010. *Earth Overshoot Day*. Available at: <[http://www.footprintnetwork.org/en/index.php/GFN/page/earth\\_overshoot\\_day/](http://www.footprintnetwork.org/en/index.php/GFN/page/earth_overshoot_day/)> [accessed 16 Sep. 2010].
- Global Unions. 2010. "Take action on jobs to sustain the recovery", Global unions' statement to the G8/G20 Ontario Summits, Canada, Trade Union Advisory Committee to the OECD (Paris).
- Greenpeace; EREC. 2009. *Working for the Climate – renewable energy and the Green Job [r]evolution* (Sydney).
- ; —. 2010. *Energy [R]evolution, a sustainable world energy outlook*, 3rd edition.
- Hendricks, B.; Campbell, B.; Goddard, P. 2009. *Rebuilding America: A National Policy Framework for Investment in Energy Efficiency Retrofits*, Center for American Progress, Aug. (Washington, DC).
- IAEA. 2006. *Brazil: A country profile on Sustainable Energy Development* (Vienna).
- ICEM. 2009. "Sustainability – a Role for Labour, a Role for the ICEM", International Federation of Chemical, Energy, Mine and General Workers' Unions (Geneva).
- IDS. 2007. "Connecting Social Protection and Climate Change Adaptation", in *Institute of Development Studies*, No. 2, Nov. (London).
- IEA. 2009. *Ensuring Green Growth in a time of economic crisis: The role of energy technology* (Brussels).
- ILO. 2007. "Green jobs: Climate change in the world of work", in *World of Work*, No. 60, Aug. (Geneva).
- . 2008. *World of Work Report 2008: Income Inequalities in the Age of Financial Globalization*, International Institute for Labour Studies (Geneva).
- ; FAO; WHO; UNIFEM. 2009. Joint submission to the UNFCCC. Available at: <<http://unfccc.int/resource/docs/2009/smsn/igo/041.pdf>> [accessed 16 Sep. 2010].
- ; Sustainlabour. 2010. *The impact of climate change on employment: management of transitions through social dialogue* (Geneva).
- ITF. 2010. *Resolution 1: Responding to Climate Change*, 42nd Congress, 5–12 Aug., Mexico City.' Federation.
- ITUC. 2007. "Trade Union Statement to COP13 United Nations Framework Convention on Climate Change", UNFCCC Bali, Indonesia, 2007, Available at: <[http://www.ituc-csi.org/IMG/pdf/COP13\\_Statement.pdf](http://www.ituc-csi.org/IMG/pdf/COP13_Statement.pdf)> [accessed 16 Sep. 2010].
- . 2009a. *A Recipe for Hunger, How the World is Failing on Food*, available at: <[http://www.ituc-csi.org/IMG/pdf/food\\_crisis\\_EN.pdf](http://www.ituc-csi.org/IMG/pdf/food_crisis_EN.pdf)>.
- . 2009b. "A Just Transition: a fair pathway to protect the climate", available at: <<http://cc2010.mx/assets/001/5232.pdf>>.
- . 2009c. "Trade unions and climate change, equity, justice and solidarity in the fight against climate change", Trade Union statement to COP15, International Trade Union Confederation, Dec. 2009.
- . 2010. Resolution No. 10: Combating Climate Change through Sustainable Development and Just Transition, 2nd World Congress, International Trade Union Confederation, 21–25 June, Vancouver, Canada.

- Kammen D.; Kapadia, K.; Fripp, M. 2004. *Putting renewables to work: How many jobs can the clean energy industry generate?* Energy Resources Group, Goldman School of Public Policy (University of California, Berkeley).
- Karamat, J. 2010. *Pakistan's Water World: The Political and Economic Impact of the Recent Floods*, Brookings up front blog. Available at: <[http://www.brookings.edu/opinions/2010/0817\\_pakistan\\_floods\\_karamat.aspx](http://www.brookings.edu/opinions/2010/0817_pakistan_floods_karamat.aspx) > [accessed 16 Sep. 2010].
- Kohler, B. 1996. *Sustainable development: a labor view – The real choice is not jobs or environment. It is both or neither*. Presentation at the Persistent Organic Pollutants Conference, held on 5 Dec., Chicago, IL. Available at: <<http://www.sdearthtimes.com/et0597/et0597s4.html> > [accessed 16 Sep. 2010].
- . 1998. *Just Transition – A labour view of Sustainable Development*, CEP Journal on-line, Summer, Vol. 6, No. 2, available at: <[http://oldsite.cep.ca/journal/1998\\_summer/9808just.html](http://oldsite.cep.ca/journal/1998_summer/9808just.html) > [accessed 16 Sep. 2010].
- Lesotho Meteorological Services. 2007. *Lesotho's National Adaptation Programme of Action (NAPA) on Climate Change*. Available at: <<http://unfccc.int/resource/docs/napa/lso01.pdf> > [accessed 16 Sep. 2010].
- Litman, T. 2009. *Smart transportation economic stimulation: infrastructure investments that support economic development*. Victoria Transport Policy Institute (VTPI). Available at: <[http://www.vtppi.org/econ\\_stim.pdf](http://www.vtppi.org/econ_stim.pdf) > [accessed: 16 Sep. 2010].
- Meehl, G. A.; Stocker, T. F.; Collins, W.D. et al. 2007. "Global Climate Projections", in *Climate Change 2007: The Physical Science Basis*. (Cambridge, Cambridge University Press), pp. 747–845.
- OECD. 2010a. *Greening jobs and skills: The local labour market implications of addressing climate change*, OECD Local Economic and Employment Development (Paris).
- . 2010b. *Interim report of the green growth strategy: implementing our commitment for a sustainable future* (Paris).
- Parry, M.L.; Canziani, O.F.; Palutikof, J.P. et al. 2007. *Technical Summary. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, IPCC (Cambridge University Press, Cambridge).
- Pollin, R.; Wicks-Lim, J. 2008. *Job Opportunities for the green economy: A state by state picture of occupations that gain from green investments*, Political Economy Research Institute University of Massachusetts (PERI), Amherst, June.
- Sanchez Lopez, Ana Belén. 2006. *Empleo en PyME del sector de las energías renovables e industrias auxiliares en España*, Instituto Sindical de Trabajo, Ambiente y Salud (ISTAS), Nov.
- Shah, A. 2008. Global Food Crisis 2008 *Global Issues*, available at: <<http://www.globalissues.org/article/758/global-food-crisis-2008> > [accessed 16 Sep. 2010].
- . 2010. "Poverty Facts and Stats", *Global Issues*, available at: <<http://www.globalissues.org/article/26/poverty-facts-and-stats> > [accessed 16 Sep. 2010].
- Stern, N. 2007. *The Economics of Climate Change: The Stern Review* (Cambridge University Press, Cambridge).
- Stevens, C. 2009. *Green Jobs and Women Workers: Employment, Equity, Equality, Draft Report*, Sustainlabour.

- Torres, R. 2009. "Income inequalities and the crisis". Presentation made at the ETUI. Available at: <<http://www.etui.org/en/Events/Past-events/2009/September-10-11-2009-Brussels-Conference-Beyond-the-crisis-Developing-sustainable-alternatives/Income-inequalities-and-the-crisis>> [accessed 16 Sep. 2010].
- UNCTAD. 2010. *World Investment Report 2010: Investing in a Low-Carbon Economy* (New York).
- UNDP. 2007. *Human Development Report 2007/2008: Fighting climate change: Human solidarity in a divided world* (New York).
- . 2009. *Fast Facts: Environment, Energy and UNDP*. Available at: <<http://www.undp.org/publications/fast-facts/FF-environment.pdf>> [accessed 16 Sep. 2010].
- ; WHO. 2009. *Energy Access Situation in Developing Countries* (New York).
- UNEP. 2007. "IPCC Report: Millions at risk of hunger and water stress in Asia unless global greenhouse emissions cut", in *ScienceDaily*, 11 Apr., available at: <<http://www.sciencedaily.com/releases/2007/04/070410134724.htm>> [accessed 16 Sep. 2010].
- ; ILO; IOE; ITUC. 2008a. *Green Jobs: Towards decent work in a sustainable, low-carbon world* (Nairobi).
- ; —; —. 2008b. *Green Jobs: Towards decent work in a sustainable, low-carbon world. Policy messages and main findings for decision makers* (Nairobi).
- UNEP; Sustainlabour. 2008. *Climate Change, its Consequences on Employment and Trade Union Action: Training manual for workers and trade unions* (Nairobi).
- United Nations. 2010. *The Millennium Development Goals Report 2010* (New York).
- Verheecke, L. 2010. Workshop on Climate Change, its impacts on employment and labour markets – Trade Unions and Climate Change, Conference News 1, International Trade Union Confederation (ITUC). Available at: <[http://www.ituc-csi.org/IMG/pdf/Conference\\_News\\_1.pdf](http://www.ituc-csi.org/IMG/pdf/Conference_News_1.pdf)> [accessed 16 Sep. 2010].
- WHO. 2009. *Protecting health from climate change: Connecting science, policy and people* (Copenhagen).
- . 2010. *UN-water global annual assessment of sanitation and drinking-water (GLAAS) 2010: Targeting resources for better results* (Geneva).
- WWF International. 2008. *Living Planet Report 2008* (Geneva). Available at: <[http://www.footprintnetwork.org/en/index.php/GFN/page/living\\_planet\\_report/](http://www.footprintnetwork.org/en/index.php/GFN/page/living_planet_report/)> [accessed 16 Sep. 2010].

# Annex I

## Climate change and examples of major projected impacts by sector

Positive  and/or negative  impacts on employment identified

Phenomenon and trend	Examples of major projected impacts by sector		
	Agriculture, forestry and ecosystems	Human health	Human settlements and society
Over most land areas; warmer and fewer cold days and nights; warmer and more frequent hot days and nights	Increased yields in colder environments; decreased yields in warmer environments; increased insect outbreaks	Reduced human mortality due to less exposure to the cold	Reduced energy demand for heating; increased demand for cooling; declining air quality in cities; reduced disruption to transport due to snow and ice; effects on winter tourism
An increase in the frequency of warm spells and heat waves over most land areas	Reduced yields in warmer regions due to heat stress and an increase in the risk of wildfires	Increased risk of heat-related mortality, especially for the elderly, chronically sick, very young and socially isolated	Reduction in the quality of life for people in warm areas without appropriate housing; impacts on elderly, very young and poor
An increase in the frequency of heavy precipitation events over most areas	Damage to crops; soil erosion, inability to cultivate land due to waterlogging of soil	Increased risk of deaths, injuries, infectious, respiratory and skin diseases	Disruption of settlements, commerce, transport and communities due to flooding; pressures on urban and rural infrastructures; loss of property
Areas affected by increases in the frequency of drought	Land degradation; lower yields and/or crop damage and failure; increased livestock deaths; increased risk of wildfire	Increased risk of food and water shortage; increased risk of malnutrition; increased risk of water- and food-borne diseases	Water shortages for settlements, industry and communities; reduced hydropower generation potentials; potentially, population migration
An increase in intense tropical cyclone activity	Damage to crops; windthrow (uprooting) of trees; damage to coral reefs	Increased risk of deaths, injuries, water- and food-borne diseases; post-traumatic stress disorders	Disruption by flood and high winds; withdrawal of risk coverage in vulnerable areas by private insurers; potential for population migrations; loss of property
Increased incidence of extreme high sea level (excludes tsunamis)	Salinization of irrigation water, estuaries and freshwater systems	Increased risk of deaths and injuries by drowning in floods; migration-related health effects	Costs of coastal protection versus costs of land-use relocation; potential for movement of populations and infrastructure

Source: IPCC (2007) and, regarding employment, UNEP and Sustainlabour (2008) – updated by the author for this publication.

## Annex II

### Examples of adaptation measures and initial identification of their positive and negative impacts

Agriculture, forestry and ecosystems	Negative effects of climate change	Examples of adaptation measures	Employment effects of some adaptation measures
	<ul style="list-style-type: none"> <li>Reduced yields in warmer regions due to heat stress</li> </ul>	<ul style="list-style-type: none"> <li>Increase productivity of paddy farming for new climate conditions</li> </ul>	
	<ul style="list-style-type: none"> <li>Damage to crops</li> <li>Soil erosion, inability to cultivate land due to waterlogging of soil</li> </ul>	<ul style="list-style-type: none"> <li>Expand non-farming economic activities</li> </ul>	
		<ul style="list-style-type: none"> <li>Farm crops that are able to face a wider variability in weather conditions. A broad range of tolerance will be more important than optimal tolerance to one stress factor</li> </ul>	<p>However, it takes 2–3 years before any income/livelihood benefits arise from new trees (fruit/fodder/fuel wood). In addition, the labour required for new crops or species may in fact be less. In these cases, workers need to be rewarded with outside funding in order for schemes to be viable</p>
	<ul style="list-style-type: none"> <li>Land degradation</li> </ul>	<ul style="list-style-type: none"> <li>Use drought-tolerant, low-growing leguminous species useful as fodder and fuel</li> </ul>	
	<ul style="list-style-type: none"> <li>Increased livestock deaths</li> </ul>	<ul style="list-style-type: none"> <li>Investigate the use of new forestry species</li> </ul>	
	<ul style="list-style-type: none"> <li>Damage to coral reefs</li> </ul>	<ul style="list-style-type: none"> <li>Promote indigenous/local technologies</li> </ul>	
	<ul style="list-style-type: none"> <li>Salinization of irrigation water, estuaries and freshwater systems</li> </ul>	<ul style="list-style-type: none"> <li>Establish local tree nurseries, contour planting</li> </ul>	
		<ul style="list-style-type: none"> <li>Fencing against livestock</li> </ul>	<p>Attention should be given to impacts on employment in pastoralist communities</p>
		<ul style="list-style-type: none"> <li>Economic diversification</li> </ul>	<p>The gradual shift of economic activity from a climate-sensitive agricultural and shrimp/fish culture or to the climate-insensitive industry and service sectors is a viable option to minimize risks, conserve natural resources and shift towards sustainable development. Training and other accompanying measures should be designed to minimize suffering to workers and their families</p>

	Negative effects of climate change	Examples of adaptation measures	Employment effects of some adaptation measures	
Human health	<ul style="list-style-type: none"> <li>Increased risk of heat-related mortality, especially for the elderly, chronically sick, very young and socially isolated</li> </ul>	<ul style="list-style-type: none"> <li>Increase capacity for management of climate-related risks</li> </ul>		
	<ul style="list-style-type: none"> <li>Increased risk of deaths, injuries, infectious, respiratory and skin diseases</li> <li>Increased risk of food and water shortage</li> <li>Increased risk of malnutrition</li> </ul>	<ul style="list-style-type: none"> <li>Adapt health-care and social care infrastructure (hospitals, nursing homes) to be more resilient to the effects of heat, gales and floods</li> </ul>	Improvements in health systems can create new and greater employment opportunities. However, for this to be true, certain conditions must be fulfilled: increased training, improved protection of health workers from occupational health and safety risks	
	<ul style="list-style-type: none"> <li>Increased risk of water- and food-borne diseases</li> <li>Increased risk of deaths, injuries, post-traumatic stress disorders</li> <li>Increased risk of migration-related health effects</li> </ul>	<ul style="list-style-type: none"> <li>Measures against health impacts (any measure that could counter increasing risks of death, injuries and illnesses)</li> </ul>	Any measure aimed at improving health conditions of workers will tackle the negative effects of climate change on available labour force and the productivity of workers, thus having a positive impact on employment	

## Annex II (cont'd)

Human settlements and society	Negative effects of climate change	Examples of adaptation measures	Employment effects of some adaptation measures
	<ul style="list-style-type: none"> <li>• Reduction in the quality of life for people in warm areas without appropriate housing</li> <li>• Disruption of settlements, commerce, transport and societies due to flooding and water shortages</li> </ul>	<ul style="list-style-type: none"> <li>• Investments in infrastructure, such as coastal defences, flood protection, drainage containment, roads adaptation</li> </ul>	<p>In areas such as infrastructure, water management, labour-based processes in public works programmes could create large numbers of jobs</p>
	<ul style="list-style-type: none"> <li>• Pressures on urban and rural infrastructures</li> </ul>	<ul style="list-style-type: none"> <li>• Make buildings, infrastructure and homes more adaptable to climate change</li> </ul>	
	<ul style="list-style-type: none"> <li>• Impacts on the tourism sector (winter tourism, Caribbean tourism)</li> </ul>	<ul style="list-style-type: none"> <li>• Technology and behavioural changes; modifications in seasonal tourism; economic diversification</li> </ul>	<p>Positive/negative: depending on regions, technology and behavioural changes could slow the deteriorating impact of climate change. However, tourism can only be salvaged in the long run by ambitious climate change policies</p>

Sector affected	Employment-related mitigation measures	Comments
Energy	<ul style="list-style-type: none"> <li>• Switch in fossil fuels from coal to gas plants</li> <li>• Expand renewable heat and power capacities, such as hydropower, solar, wind, geothermal and agro-energy</li> <li>• Expand energy audits of industrial and commercial facilities</li> </ul>	<p>We should expect losses in the coal sector and some new employment opportunities in the gas sector. The closure of coal centrals will probably also have effects on employment in the coal-mining sector</p> <p>While employment is expected to grow in the renewable energy sector, losses in the fossil fuels/electricity sector are to be expected. Substitutability of jobs is still unclear</p> <p>Employment opportunities are expected to arise from investments in this area</p>
Buildings	<ul style="list-style-type: none"> <li>• Promote and invest in efficient lighting and day light</li> <li>• Promote the use of more efficient electrical appliances, and heating and cooling devices</li> <li>• Improve insulation</li> </ul>	Buildings renovation is a labour-intensive source of direct employment. However, the quality of the jobs is weak and the building sector will thus have to make an effort on workers' training and qualification
Transport	<ul style="list-style-type: none"> <li>• Encourage shifts from road transport to rail and from private to public transport systems</li> <li>• Further develop agrofuels, above all second-generation ones</li> <li>• Reduce individual transport use</li> </ul>	<p>Rail should benefit from the shift in modes of transport, mainly in freight and passengers. Workers in the road transport sector (which should see its importance reduced) could be retrained to work in rail or other public transport options</p> <p>While agrofuels are labour-intensive options, labour conditions, as well as overall environmental impacts need to be looked at more carefully. Labour-sound development of second-generation agrofuels could bring jobs to poor agricultural communities</p> <p>The consequences of this measure will have different impacts depending on how the early industry shifts towards cleaner vehicles, being positive on a "first mover wins" dynamic</p>
Industry	<ul style="list-style-type: none"> <li>• Implement energy efficiency measures</li> <li>• Promote material recycling and substitution</li> <li>• Control non-CO<sub>2</sub> gas emissions</li> <li>• Develop process-specific technologies</li> </ul>	Some sectors already suffering from outsourcing could be impacted by climate protection measures. However, R&D and a global move towards cleaner production could avert these negative impacts

Source: IPCC (2007) and, regarding employment, Sustainlabour (2008) – updated for this publication.



