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Employment and labour market implications of climate change

Introduction: The challenge of climate change

1. This paper discusses the implications for employment and decent work of climate change. [1] It focuses on the search for ways to combine growth, the reduction of poverty and inclusive development with a much reduced emission of greenhouse gases (GHG) and measures to adapt to climate changes that are already under way. The framework for this discussion is the concept of sustainable development agreed at the Johannesburg Summit in 2002, which assumed "a collective responsibility to advance and strengthen the interdependent and mutually reinforcing pillars of sustainable development – economic development, social development, and environmental protection". [2] The paper builds on the discussion of the issue in the Working Party on the Social Dimension of Globalization in the November 2007 session of the Governing Body. [3]

2. The time horizon for the transition to a sustainable development trajectory for the global economy is medium to long term, although there is an urgent need to accelerate international action on climate change. Negotiations have started under the UN Framework

[1] The present paper is adapted from the ILO's submission to the G8 Meeting of Labour and Employment Ministers in Niigata, Japan, May 2008, "Global challenges for sustainable development: Strategies for green jobs," prepared by the Policy Integration and Statistics Department. It also draws on *Green Jobs: Towards Decent Work in a Sustainable Low-Carbon World*, a report undertaken by the Green Jobs Initiative initiated by UNEP, the ILO, the IOE, and the ITUC, and produced by Worldwatch Institute with technical assistance from Cornell University's Global Labor Institute, (UNEP, Sep. 2008). Available at www.unep.org/labour_environment/features/greenjobs.asp.

[2] Johannesburg Declaration on Sustainable Development, para. 5. It also included a paragraph (28) on employment: "We also agree to provide assistance to increase income-generating employment opportunities, taking into account the Declaration on Fundamental Principles and Rights at Work of the International Labour Organization."

[3] Oral report by the Chairperson of the Working Party, H.E. Mr. D. Jayatilleka, Ambassador and Permanent Representative of Sri Lanka to the United Nations in Geneva, GB.300/18(Rev.), Nov. 2007.

Convention on Climate Change with a view to an agreed outcome at the Conference of the parties in Copenhagen in December 2009 which would avoid a rupture in the process of international target setting and implementation after the expiry of the Kyoto Protocol in 2012.

3. Scientists suggest that in order to avoid dangerous, possibly irreversible and self-reinforcing climate change, atmospheric concentrations of GHGs should not exceed the equivalent of 450 parts per million (ppm) CO_2. Even this level would result in a warming of 2°C on average. Stabilization scenarios show that a 450 ppm maximum requires global emissions to peak over the next 10–20 years. At the same time, the trend scenario of the International Energy Agency projects a 60 per cent increase in global demand for energy until 2030, needing a total investment of US$20 trillion of which about half in developing countries. [4] While historically, industrialized countries have been responsible for the bulk of emissions, developing and rapidly industrializing countries are becoming major emitters in aggregate despite comparatively low emissions per capita. Action by the industrialized countries alone, therefore, will not be sufficient and poses starkly the issue of how to balance achievement of international commitments to poverty reduction and the containment of climate change.

4. Global warming follows emissions with a long time lag. The world will experience further climate change even if emissions stopped today, albeit to a much lesser extent than otherwise. Adaptation to climate change in an effort to reduce its negative impacts is therefore inevitable. Most impacts in the short to medium term will come from increased variability of weather and more frequent and extreme events like storms, droughts, floods, and heat waves.

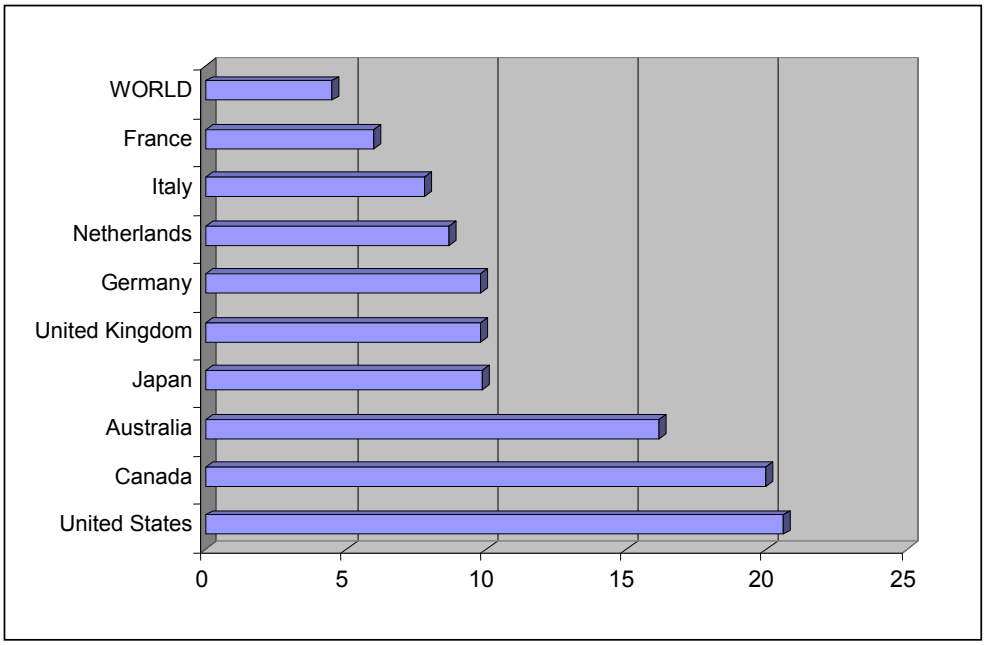
5. Although developing countries have historically contributed least to emissions causing climate change, they stand to suffer most because many are vulnerable and least able to adapt to extreme environmental events. Particularly at risk are the heavily populated areas such as developing country mega-deltas and small island States. The economic sectors most dependent on the weather, such as agriculture and tourism, are likely to be most affected along with settlements and industry located in coastal and river flood plains, as well as other areas prone to storms.

6. In the medium to long term, projected climate change from current trends will lead to serious disruption of economic and social activity in many sectors on all continents. However the technical and economic potential exists to reduce emissions to levels of climate change considered tolerable. “Mitigation”, i.e. measures to reduce emissions or remove GHGs from the atmosphere are both necessary and cheaper than inaction. [5]

[4] World Energy Outlook 2007, International Energy Agency, http://www.worldenergyoutlook.org/2007.asp.

[5] Stern Review Report on the Economics of Climate Change, http://www.Hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm.

CO_2 emissions per capita (tons), 2004



Source: UNDP Human Development Report 2007, cited in Commission on Growth and Development, The Growth Report: Strategies for Sustained Growth and Inclusive Development (Washington, the World Bank, 2008), p. 86.

7. Making economic growth and development compatible with stabilizing the climate calls for "low carbon economies" worldwide. A reduction of emissions by half compared to trend would take cuts of 60–80 per cent in industrialized countries and still need 30 per cent lower levels in developing countries. Decoupling economic growth from emissions supposes major advances in energy efficiency of products and services, in power generation, in buildings and transport, a significant increase in the use of renewable energy, as well as lower emissions from land use. New technologies will be needed, including carbon capture and storage, together with additional development assistance to least developed countries in particular. While much of the implied "price tag" of the above can be thought upon positively as investment opportunities, aid to the poorest countries implies, at the very least, a redirection of existing overseas development assistance.

8. Equity in responding to the climate change challenge is likely to be a key determinant of success. Ministers of the Group of 24 developing countries have expressed support for urgent collective action to mitigate and adapt to climate change: "They stressed, however, that in line with the principle of common but differentiated responsibilities, these cooperative actions need to be equitable, taking into account the low historical contribution and still much lower per capita energy use by developing countries, the much more adverse impact on them from climate change, and their unmet development needs." [6] For industrialized and developing countries, beyond ensuring that sustained economic growth remains a paramount objective, equity in the handling of employment transitions is key to the political sustainability of effective global action to reduce GHGs.

[6] Intergovernmental Group of Twenty-Four on International Monetary Affairs and Development, communiqué, 11 Apr. 2008, http:www.g24.org/04-08ENG.pdf.

Climate change and labour markets

9. There is growing awareness that employment and labour policies can contribute to a smooth transition to more sustainable growth by identifying opportunities for green jobs, greening existing jobs, and easing the phasing out of unsustainable jobs. Strategies for green jobs are set to become an increasingly important part of employment, and labour ministers' responsibilities, as well as the activities of employers' organizations and trade unions.

10. The era emerging is one of policy induced, widespread economic restructuring which, like all episodes of economic restructuring, has vast implications for the quantity, the quality, and the location of labour. In addition, future development paths need to shift onto a low carbon trajectory. Such restructuring engages all of the core competencies and activities of the ILO.

11. Just as there is increasing concern that the current path of globalization is yielding too few decent jobs, so is there concern that we cannot continue with growth at the expense of environmental quality. We are therefore in a period of transition, searching for the policies and the leadership that can take us into a sustainable development path, where social and environmental dimensions of globalization are an integral part of economic policy-making. Transitions in employment structures and in workplaces are central to this process. [7]

12. Employment patterns and labour markets are, of course, in constant change, driven by many factors, including technology, trade, finance, demographics, demand cycles – as well as the environment. Maintaining a policy framework that facilitates and encourages change is one of the main responsibilities of employment and labour ministers. Climate change and other environmental issues add a dimension to that process of change. The future will not be "business as usual" and will represent yet another management challenge.

The employment impact of climate change

13. Climate change itself, adaptation to it and efforts to arrest it by reducing emissions, have far-reaching implications for economic and social development, for production and consumption patterns, and therefore for employment, incomes and poverty reduction. One of the most visible risks concerns food and economic security, particularly in regions and sectors based on agriculture. The Stern Review has drawn attention to the fact that 22 per cent of the global population are dependent on agriculture, [8] and that the sector also has the highest concentration of the world's poor (75 per cent of the poorest people in the world, the 1 billion people who live on less than US$1 a day). Not least because of its impact on agricultural livelihoods, climate change poses a threat to the achievement of the Millennium Development Goals (MDGs), a threat exacerbated by the recent rise in food commodity prices. A further MDG-related impact is on health, which will also affect the workforce, particularly in developing countries. Another weather-dependent sector is tourism, where employment has been growing fast.

14. In all three sectors, agriculture, tourism, and health, women are likely to be affected more than men. Women predominate among the poorest and are disproportionately concentrated

[7] Summit Declaration on Growth and Responsibility in the World Economy, 7 June 2007, (para. 22).

[8] The ILO estimates on the contrary that 36 per cent of world employment was in agriculture in 2006, KILM, 2008.

in agriculture and tourism. Among other things, therefore, the impact of climate change could have a negative gender dimension. Moreover, the share not only of poor pay but also poor working conditions can be substantial in the aforementioned sectors, which can make women doubly vulnerable to adverse effects.

15. More frequent and severe natural disasters are likely to trigger or accelerate migration flows and could increase existing political tensions and instability. The response to such crises could help to make local societies more resilient if it aimed at adapting livelihoods rather than short-term disaster relief to return to the original situation. Access to basic social protection systems also cushion the impact of disasters and help prevent temporary loss of earnings becoming chronic poverty. The problem lies in the fact that, while many of the poorest countries are most vulnerable to natural disasters, they are also the ones with least social protection provision.

Job losses, but job gains as well

16. Major investments in adaptation could offer significant employment and income opportunities through extending coastal defences, reinforcing buildings and infrastructure, water management and harvesting. Adaptation will require the transfer of new technologies on a large scale and involve the relocation of exposed settlements and industry. Adaptation in agriculture could have positive or negative impacts on employment and income, depending on the labour inputs of new crops and farming practices and their compatibility with smallholder farming. The availability of finance on affordable terms to low-income farmers, small enterprises and poor communities is an essential element in adaptation investment. All of the above requires both donor assistance and strong policy guidance of the State, as reflected in the many countries that have already adopted national programmes on sustainable development.

17. It is difficult to predict just which jobs will disappear, as, among other reasons, many currently unsustainable jobs may simply be transformed, e.g. through the adoption of "clean coal" technology. That said, jobs connected with fossil fuel generation are in decline, as shown in the table below – although that decline is for many reasons, including ones unrelated to policies on climate change, such as mechanization.

Fossil fuel (and metals) mining employment in selected countries, 1996–2006

Country	**1996** (in thousands)	**2006** (in thousands)	**Change** (%)
China	9 020	5 580	-38
Romania	241	120	-50
Ukraine	4 390	4 037	-7
Slovakia	34	16	-52
South Africa	603	398	-34
United States	569	687	+21
United Kingdom	107	103	-4
Malaysia	35	27	-22

Source: *Green Jobs: Towards Decent Work in a Sustainable Low-Carbon World*, op. cit.

18. A literature review for the ILO of the limited number of quantitative assessments of the impact of mitigation measures on labour markets, mostly in industrialized countries, finds

that a transition to a low-carbon economy should lead to a net increase in employment. [9] This typically small net gain is, however, the result of major labour market transitions, with substantial losses of some jobs more than compensated by increases in others. [10] It is, moreover, plausible to assume that the jobs lost could be disproportionately high-paying jobs in unionized sectors, as most jobs, for example, in the fossil fuel industry. If this were the case, then it highlights the role that collective bargaining could play in labour market adjustment at least social cost – for example, on skills needs to facilitate that adjustment. The table below shows estimates of employment in the renewable energy sector for 2006.

Employment estimates in the renewable energy sector, global and selected countries, 2006

Renewable energy source	World/selected countries	Employment
Wind	World	300 000
Solar photovoltaic	World	115 000
Solar thermal	China, Europe, United States	624 000
Biomass/biofuels	Brazil, United States, China, Germany	1 174 000
Hydropower	Europe, United States	39 000
Geothermal	United States, Germany	25 000
Renewables combined		**2 277 000**

Source: *Green Jobs: Towards Decent Work in a Sustainable Low-Carbon World*, op. cit.

19. Employment generated in China's renewables sector is already substantial, as shown below, and is growing.

Estimates of Chinese employment in the renewables sector, 2006

	Wind power	Solar photovoltaic	Solar thermal	Biomass	Total
Generation	6 000	2 000	–	1 000	9 000
Manufacturing	15 000	38 000	400 000	15 000	468 800
Service	1 200	15 000	200 000	250 000	466 200
Total	**22 200**	**55 000**	**600 000**	**266 000**	**943 200**

Source: *Green Jobs: Towards Decent Work in a Sustainable Low-Carbon World*, op. cit.

20. Mitigation-related activities are likely to be more labour-intensive than the more capital-intensive, "carbon-based" activities they replace. Also, projections for employment growth in emerging energy sectors are remarkably strong. This is clear over recent years for Germany, as shown below.

[9] "The impacts of climate change on employment and incomes – A review of the literature", Centre for Sustainable Production and Consumption, commissioned by the ILO, forthcoming.

[10] "Climate change and employment", with the support of the DG Environment, ETUC study, Syndex, Istas, Wuppertal Institute, SDA (2007), at http://www.etuc.org/a/3676; "Renewable energy sector in the EU: Its employment and export potential", a final report to DG Environment, Ecotec study, Research and Consulting Ltd, United Kingdom, 2002, at http://www.tuuleenergia.ee/uploads/File/employment%20and%20export.pdf; S. Laitner, S. Bernow and DeCicco, 1998: "Employment and other macroeconomic benefits of an innovation-led climate strategy for the United States", Energy Policy, 26(5), pp. 425–432; D.M. Kamman, K. Kapadia, M. Fripp, 2004: "Putting renewables to work: How many jobs can the clean energy industry generate?", Renewable and Appropriate Energy Laboratory (RAEL) report, University of California, Berkeley.

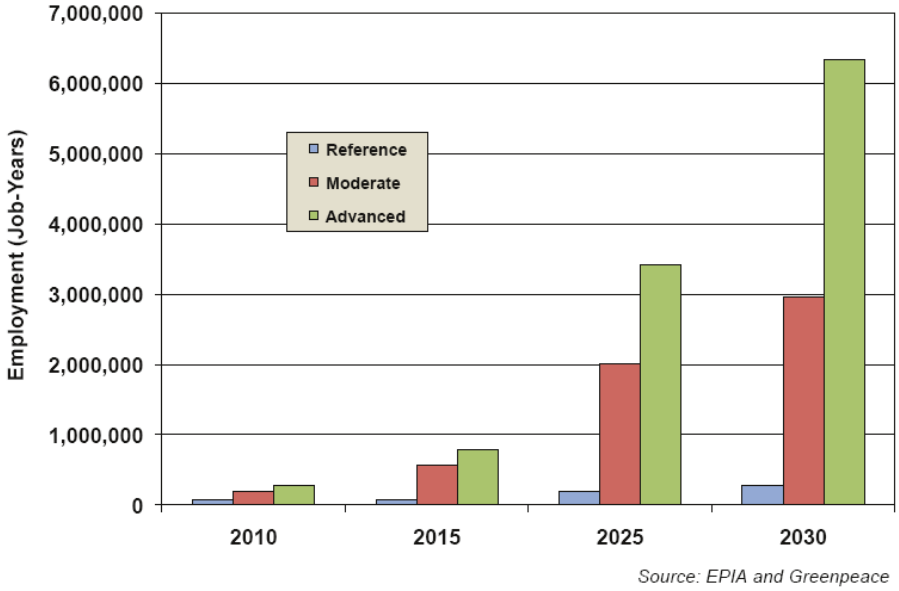
Employment in the German renewables sector, 1998, 2004 and 2006

	1998	2004	2006	Expected growth 2006–10 (%)
Wind power	16 600	63 900	82 100	6.8
Solar energy	5 400	25 100	40 200	49
Hydropower	8 600	9 500	9 400	n.a.
Geothermal	1 600	1 800	4 200	74
Biomass	25 400	56 800	95 400	37
Services	10 000	n.a.	n.a.	n.a
Total	**66 600**	**157 100**	**231 300**	**n.a.**

Source: *Green Jobs: Towards Decent Work in a Sustainable Low-Carbon World*, op. cit.

21. It is also clear from scenarios forecasting employment growth in the solar power sector, as shown by the figure below.

Global solar employment projections, 2010–30



Source: Green Jobs: Towards Decent Work in a Sustainable Low-Carbon World, op. cit.

22. Most of these transitions are likely to take place within economic sectors including agriculture, power generation, energy-intensive industries, construction and transport. All aspects of adaptation and of mitigation require new technical and often also entrepreneurial skills. Increases in energy efficiency and in renewables will be a big part of the equation. While the IPCC report has emphasized the significant potential to create new employment of adaptation and mitigation efforts, generally employment has only featured marginally in the climate debate as a "co-benefit" of mitigation measures. This view overlooks the fact that the benefits for employment and development are vital for making many mitigation measures technically feasible, economically viable, socially acceptable, and politically sustainable. And this fact, in turn, underscores the vital role that the ILO and its constituents can play in climate-induced labour market transition.

Green jobs benefits in developing countries

23. The point has been made, and rightly so, as to the vulnerability of many developing countries in adjusting to climate change. That, however, does not by any means preclude the significant "green" employment opportunities that exist in developing countries. Existing and reported green jobs tend to be concentrated in certain countries and regions. This, however, is a reflection of proactive policy initiatives and current investment patterns, rather than inherent to the concept. There are numerous case examples and pilot projects that demonstrate the scope and the potential for green jobs in developing countries. Where data exists, such as on renewable energy, half of the reported jobs are found in developing countries. Green jobs in emerging economies and developing countries include not just opportunities for managers, scientists and technicians, but primarily benefit a broad cross-section of the population that needs them most: young people, women, farmers, rural populations and slum dwellers.

24. The contribution that green jobs will make to clean economic growth, development and poverty reduction will ultimately depend on the quality of these jobs. The "Green Jobs" report finds that many existing green jobs are of poor quality and those in recycling, construction or biofuels for example, are often informal in nature. Employment in recycling is often precarious – involving serious occupational and public safety and health hazards and low wages and incomes. Serious labour and human rights violations have been recorded in relation to feedstock production for biofuels. Thus, while there are clearly constraints and obstacles, the potential for green jobs is still enormous.

25. Consider, for example, the contribution that one NGO, Grameen Shakti, has made in Bangladesh in the diffusion of renewable energy (and access to energy for those previously unconnected to any grid), as shown in the table below. Data on developing country opportunities in green employment is sparse to date, and a further effort at collection of this data is warranted.

Grameen Shakti's renewable energy services in Bangladesh

Total installation of solar panels	170 000
Total number of improved cook stoves	15 500
Total installation of biogas plants	4 500
Number of trained technicians	2 575
Number of trained customers	75 050
Planned biogas plant construction, 2012	500 000
Planned improved cook stoves, 2012	10 000 000
Green job creation by 2015	100 000

Source: *Grameen Shakti at a Glance,* Grameen Shakti, Dhaka, Bangladesh, June 2008.

Opportunities and challenges for employment

Adjustment at the enterprise level: A challenge for all, SMEs in particular

26. The climate change challenge is global, but meeting it requires sustained transformations in enterprises at local level. The reflex to "reduce, reuse and recycle" can enter the culture of investment, production and employment, but requires leadership by labour and

employment ministers, employers' organizations and trade unions. The potential of tripartism in this regard was demonstrated by the adoption of a comprehensive policy statement on the "Promotion of sustainable enterprises" at the 2007 International Labour Conference. [11] An increasing number of companies include sustainable development goals in their corporate objectives and reporting. There are also several sectoral initiatives aimed at promoting responsible business practice on both the environment and also labour and social issues.

27. Two issues would seem fundamental. First, the vast majority of enterprises in the world consists of small firms that may not possess either the financial wherewithal, or the information on climate change, or both, necessary to adjust their business practices. Moving to a sustainable development trajectory will require a particular focus on small enterprise. The ILO's social partners have a major stake here. The ILO is working in China on a programme that will include design and testing of ways to improve energy efficiency in small enterprises along the lines of the successful ILO programme "Work improvement in small enterprises".

28. It is also true that, through their participation in global value chains, multinational enterprises (MNEs) have a significant role to play in the diffusion of best practice in adjusting to the challenges of climate change. One such role, for example, is through technology transfer to small firms, a vital feature of multinational business, as endorsed by the Tripartite Declaration of Principles concerning Multinational Enterprises and Social Policy.

29. Second, labour market adjustment to sustainability, both externally, and internally within the firm, is, depending on the national context, an appropriate subject of collective bargaining, but, more generally, a potentially most useful subject of information exchange between employers' organizations and trade unions. Instances in which the social partners are negotiating change are increasing in number, with perhaps the best-known example being at the sectoral level in Spain, as discussed in the box below.

Spain's tripartite social dialogue on climate change

Seven tripartite round tables on social dialogue at sector level, and one general round table were created under law 01/2005, which committed Spain to the implementation of the Kyoto Protocol. A Royal Decree (202/2006) subsequently defined the composition, role, and functioning of the round tables. The institutional legitimacy of the round tables is thus statutorily based.

The round tables were created as a mechanism for ensuring the participation of the social partners in the implementation of Spain's National Plan of Action (NPA) on the reduction of GHGs, and focus their attention on the plan's effects on competitiveness, employment stability, and social cohesion. The sectors include electricity, refineries, cement, glass, ceramics, steel and paper. An eighth sector-level round table was created in 2007 to cover other sectors not directly addressed by the NPA.

Each tripartite round table is comprised of six representatives of each of the parties. The general round table has the function of recognizing and articulating the various proposals to emerge from the individual sector-level round tables, and of submitting these to the relevant governmental agency or ministry. While the Government is not obliged to act on the proposals, evidence to date suggests that they are taken seriously into account in decision-making on climate change.

[11] Conclusions concerning the promotion of sustainable enterprises, International Labour Conference, June 2007. http://www.ilo.org/dyn/empent/docs/F836599903/ILC96-VI-2007-06-0147-2-En.pdf.

While the round tables have identified a variety of concerns in addressing commitments to lower emissions, none of the actors has identified insuperable difficulties relative to competitiveness or employment. The information used by the round tables comes for the most part from the Government's data on emissions. In a more recent meeting of the round tables, a proposal was made for the creation of specific, sector-level indicators relative not only to emissions, but to aspects of competitiveness and employment as well.

Interviews conducted by the ILO* found a very high degree of satisfaction with the functioning of the round tables, particularly among trade union representatives. The round tables are considered an instrument of great usefulness for the exchange of information, fostering understanding, and minimizing the risk of conflict. Replicability of the Spanish model of social dialogue on climate change is clearly feasible, particularly in view of the European tradition of tripartism. In countries without such a strong tradition, there are other modalities for an exchange of information between employers, workers, and the representatives of both, the most traditional form being through collective bargaining.

* El impacto del cambio climático en el empleo: la gestión de las transiciones a través del diálogo social, unpublished study undertaken by Fundación Sustainlabour, Fundación Internacional para el Desarrollo Sostenible, and the ILO, Madrid 2007, pp. 8–10.

30. There is a need and an opportunity for the ILO to expand the climate change debate to include the investment, production, and employment implications of adaptation and mitigation measures. The transformation to a greener economy will take place in enterprises all over the world, where the perspectives of the ILO's constituents can determine the success with which progress is achieved on global goals.

Decent Work in a greener economy

31. "Green jobs" does not lend itself to a tight definition but certainly includes the direct employment which reduces environmental impact ultimately to levels that are sustainable. This includes jobs that help to reduce the consumption of energy and raw materials, decarbonize the economy, protect and restore ecosystems and biodiversity and minimize the production of waste and pollution. Green jobs can lead to lower environmental impacts directly, e.g. in the transport sector as railway or subway operators providing energy-efficient mass transportation, or indirectly, e.g. as technicians in industry or logistics managers in services reducing energy consumption in manufacturing and delivery of services.

32. The range of profiles of green jobs stretches from highly skilled research and development or management functions through to technical and skilled levels to the relatively low skilled. The largest numbers of already existing and future green jobs is concentrated in sectors directly linked to the use of energy and the recovery of raw materials:

- improvements in energy efficiency, particularly in the building sector (renovation of the existing built environment), but also industry and transport;
- renewable energy;
- mobility: mass transportation in particular;
- recycling and reuse;
- sustainable use of natural resources: agriculture, forestry and fisheries;
- environmental services.

33. A somewhat wider concept of "green jobs" might embrace any new job in a sector which has a lower than average environmental footprint, contributes to improving overall performance, albeit perhaps only marginally. This more relative notion poses a problem to those who set out to count and monitor the number of green jobs. For example, workers

assembling hybrid cars or cars with less than, say, 120g/km of CO_2 emissions are performing "greener" jobs than other car workers because these types of cars contribute significantly less to GHG emissions. However, if transport volumes continue to rise as projected, a larger number of cars, even if they are cleaner, will still not be sustainable.

34. The different shades of green complicate accounting, but the real significance of the concept of "green jobs" is not so much in the precise volume of direct green jobs that are being created, but the "greening" of existing and future jobs and the consequent transformation of employment patterns and skills needs. For example, an auto mechanic is a traditional occupation – it becomes "greened", however, when those skills are applied to hybrid cars rather than to the standard combustion engine. The table below highlights the skills challenge in the transformation to a greener world.

Skills for a greener world

35. New occupations and the "greening" of existing ones impose a widespread challenge on education and vocational training systems. This is so, even if "the vast majority of green jobs are in the same areas of employment that people already work in today", as shown in the table below.

A greener economy with familiar occupations

Strategies for green economy investments	Representative jobs
Building retrofitting	Electricians, heating/air conditioning installers, carpenters, construction equipment operators, roofers, insulation workers, industrial truck drivers, construction managers, building inspectors
Mass transit	Civil engineers, rail-track layers, electricians, welders, metal fabricators, engine assemblers, production helpers, bus drivers, first-line transportation supervisors, dispatchers
Energy-efficient automobiles	Computer software engineers, electrical engineers, engineering technicians, welders, transportation equipment painters, metal fabricators, computer-controlled machine operators, engine assemblers, production helpers, operations managers, auto mechanics
Wind power	Environmental engineers, iron and steel workers, millwrights, sheet metal workers, machinists, electrical equipment assemblers, construction equipment operators, industrial truck drivers, industrial production managers, first-line production supervisors
Solar power	Electrical engineers, electricians, industrial machinery mechanics, welders, metal fabricators, electrical equipment assemblers, construction equipment operators, installation helpers, labourers, construction managers
Cellulosic biofuels	Chemical engineers, chemists, chemical equipment operators, chemical technicians, mixing and blending machine operators, agricultural workers, industrial truck drivers, farm product purchasers, agricultural and forestry supervisors, agricultural inspectors

Source: R. Pollin and J. Wicks-Lim, *Job Opportunities for the Green Economy*, Political Economy Research Institute, University of Massachusetts, Amherst, June 2008, p. 2.

36. Demand for eco-friendly products is likely to expand geometrically. It is therefore necessary to ensure that skill shortages do not become a constraint on meeting that demand – and, as such, a constraint on achieving sustainability. This will require the acquisition of new skills, or an extension or reorientation of existing knowledge and skills. Changing consumption patterns are an important driver of changing product specifications and standards. Both require new knowledge in old jobs. The table below demonstrates new skills needs in the building sector, as foreseen in New South Wales, Australia.

New skills needs for the building/housing sector

Building design and drafting capacities to enable "design-in" sustainability
Compliance with regulations, codes, and voluntary standards
Knowledge of sustainable building products that embed energy efficiency and how best to use them
Knowledge of sustainable construction techniques
Installation and maintenance of new technologies
Effective management of increasingly complex facilities and related infrastructure
Knowledge of sustainable building principles for sales promotion
Knowledge of resource management (including waste minimization and recycling)

Source: *Skills for Sustainability*, Board of Vocational Education and Training, New South Wales, Australia, 2008.

37. Another way of looking at the various occupations implied by the shift to greener jobs is to consider that there are important indirect employment effects for every direct job created in the new, green industries, as shown for the United States below.

Direct and indirect jobs in the US renewables sector, 2006

Industry segment	Direct jobs	Direct and indirect jobs
Wind power	16 000	36 800
Photovoltaics	6 800	15 700
Solar thermal	800	1 900
Hydroelectric power	8 000	19 000
Geothermal	9 000	21 000
Ethanol	67 000	152 000
Biodiesel	2 750	6 300
Biomass power	66 000	152 000
Fuel cells	4 800	11 100
Hydrogen	4 000	9 200
Total private industry	**181 150**	**427 000**
Federal Government	800	1 850
Department of Energy Labs	3 600	8 300
State and local government	2 500	5 750
Total Government	6 900	15 870
Trade and professional associations, NGOs	1 500	3 450
Grand total	**193 550**	**446 320**

Source: *Green Jobs: Towards Decent Work in a Sustainable Low-Carbon World*, op. cit.

Green work and Decent Work not always synonymous

38. A further consideration is the quality of green jobs, and the fact that, however green, they may not equate with decent work. Many green jobs in recycling, construction, or in the biofuels sector, for example, are currently informal, and subject to dangerous and/or arduous working conditions. Recycling, especially in developing countries, is often precarious employment, involves serious occupational as well as public safety and health hazards, and generates less than living wages and incomes. Feedstock production for

biofuels can also involve excessive workloads, exposure to hazardous chemicals, and, here as well, the violation of fundamental rights such as the use of child and slave labour. This highlights the developmental character of any path to sustainability. It is not possible to address the purely environmental dimension without also focusing on the national and international social and economic policies needed to expand opportunities for decent work, and the internationally accepted standards on which policies are based. These include freedom of association and the right to collective bargaining being among the most fundamental of these, and enabling tools for the promotion and extension of other basic rights.

39. Other international labour standards provide practical guidance for green jobs that are also decent, particularly instruments on safety and health, chemicals and working conditions. The transformation of economies and workplaces could become a major driver for the broader application of labour standards through a combination of awareness raising, regulation and inspection, corporate social responsibility, and collective bargaining backed by clauses on the right to information in collective agreements.

40. An environmentally sustainable future path must take as a point of departure the developmental needs of each country. It is one of the key challenges in the transformation to clean development to ensure that the green jobs associated with it are decent work and contribute to socially sustainable development. This is a significant challenge for the ILO and its constituents.

Adjustment at the sector level

41. This section focuses on energy efficiency, renewable energy, recycling, and the management of natural resources.

Energy efficiency

42. Energy efficiency gains have historically been one of the biggest contributors to reductions in emissions. They will require the transfer and deployment of new technology. Much of the capital stock of buildings and equipment is long-lived and has slow renewal rates. The process is one of substantial changes in working conditions, skills needs, the use of new materials in which new energy-efficient product standards have been embedded, and the planning of work. The significant and often low-cost contributions from improvements in existing processes and facilities can only be achieved by the active involvement of employers and workers and their representatives.

43. Energy efficiency gains are often the result of investment in better technology, but there is a large and often untapped potential for improving working methods and procedures. Joint initiatives by employers' organizations and trade unions for "greening the workplace" can lead to significant improvements in energy efficiency and resource use with little or no capital investment and at low overall cost. Gains in energy efficiency can be achieved in *all sectors*, but the potential is greatest in construction.

44. Buildings consume the largest share of total energy. They typically account for 30–40 per cent of demand and a similar share of GHG emissions. According to the IPCC, buildings also have the highest potential of all sectors to reduce emissions. The energy efficiency of buildings can often be improved by 50 per cent and more. In many countries, zero or negative energy houses will become the building standard in the near future, increasing the cost of new construction by as little as 5–10 per cent. However, the useful life can be

60–100 years. Renovation of this "built environment" is labour-intensive, and requires customized work, typically provided by local enterprises and skilled workers.

45. More than half of the energy-saving potential in buildings is in developing countries, and almost a third of the emissions reductions carry negative net cost over a relatively short period of time, i.e. they pay for themselves through the savings on the energy bill. Germany has recently been further expanding fourfold a renovation programme which had already been in place for a number of years. Under this programme – probably the largest worldwide – every 1 billion euros invested in the building stock safeguards or creates around 25,000 jobs. [12] The social partners in the construction sectors played an active role in the design and implementation of the programme. In addition to the employment potential, energy efficiency measures can contribute to poverty alleviation. Poor households tend to spend disproportionate shares of their incomes on energy for electricity, heating and transport. Efficiency gains often translate into improvements in real incomes for the poor.

Renewable energy

46. As illustrated earlier in the tables, renewable energy in wind, solar thermal and photovoltaic, small hydro, geothermal, and bioenergy represents the most readily counted source of green jobs. There are at least 2.2 million jobs in equipment manufacturing, installation and operation of renewable energy already, with half of them in the developing world. Investment has been rising at 20 per cent per year and the employment in this sector could exceed 20 million by 2030.

47. Bioenergy, such as alcohol produced from starch or sugar, and biodiesel derived from oil crops to be used as fuel for cars, or wood and other biomass for power generation have the highest employment elasticities of all. Studies for India, for example, suggest that every hectare of energy plantation can generate as much as one full-time job. These would be green jobs in most cases. Small-scale renewable energy including biomass could be used for decentralized power generation for the 1.6 billion or more people who currently do not have access to any modern form of energy.

48. However, there is also a substantial downside to the development of bioenergy. Four factors are most important. First, and as noted earlier, not all work in this sector can be described as decent work – both income and working conditions on sugar plantations and the use of child and forced labour gravely undermine the social component of sustainability. Second, while biofuels of various sorts might reduce GHG emissions, they by no means eliminate them, as, for example, solar energy does. Indeed, reducing total reliance on fossil fuels through the use of biofuels is likely to be as cost-driven, as it is "sustainability"-driven. Third, there is no guarantee that the value chain of biofuel production is inherently green: are there instances where it leads to deforestation, soil erosion, or water depletion? Finally, and most controversial, organizations as diverse as Oxfam and the World Bank have credited the conversion of food-crop land to biofuel production to be a very significant factor in the overall rise of food commodity prices, a trend, once again, that impacts the poor in particular.

49. Project experiences demonstrate improvements to the quality of life of the poor. For example, experience from Bangladesh shows that, where there is energy, there can be electric light generation which, in turn, allows children a better (and cleaner) environment

[12] German Environment Ministry (2007): "What is the German Government doing to boost energy efficiency?", http://www.bmu.de/english/energy_effiecienc/buildings/doc/38270.php.

in which to do their homework, and at the same time allows local commerce, such as restaurants, to expand their businesses.

Recycling and the circular economy

50. Recycling and the circular economy are essential for eliminating waste and closing the material cycle of production and consumption. Recycling already accounts for a large share of identifiable green jobs, and rising commodity prices are making it more and more competitive. Materials, in particular metals like aluminium but also glass and paper, which are energy-intensive to produce, can be profitably recycled, reducing energy inputs and emissions. In European countries, recycling rates for such materials are 50–80 per cent.

51. Total employment in recycling in China, for example, is estimated to be 10 million. A relatively recent but fast growing segment is the recycling of information technology products in China as part of a global production chain. Yet very poor working conditions and serious health and environmental hazards are widespread. In this case, the "recycling" of dirty jobs to developing countries is an issue worthy of examination, but so is the promotion of international labour standards to improve working conditions.

Sustainable management of renewable natural resources

52. Sustainable management of renewable natural resources is a key area from an environmental as well as from a food security and employment perspective. Agriculture and forestry are among the sectors most affected by climate change but have also been contributing substantially to GHG emissions. Conversion of forests for agriculture or other land uses has been responsible for 20–25 per cent of CO_2 emissions. Emissions from deforestation are particularly evident in Indonesia and Brazil. Major efforts are needed to develop agricultural and forestry production systems which provide decent incomes and livelihoods and at the same time reduce emissions, consume less water, and maintain soil fertility and biodiversity.

Policy responses and the role of the ILO

53. Facing up to the challenge of climate change involves a broad spectrum of labour market institutions and interventions in which the ILO can claim expertise. Several of these are briefly detailed in the table below. Three of the ILO's main tools are labour market analysis, social protection, and social dialogue. Good analysis of possible labour market impacts is vital to good policy design, social protection policies provide a cushion for those who may find themselves on the downside of transitions.

The labour market dynamics of climate change in relation to the ILO's core areas of expertise

Area	Comment
Employment-Intensive Infrastructure Programmes (EIIP)	Adapting to the challenge of climate change will for the most part be private sector-led, with or without the inducement of policy. But governments also have an important, direct role to play, in part through their investments in infrastructure. The ILO has long experience in building sustainability into EIIP projects.
Social protection	While the extension of social protection is a general necessity, two issues relating to climate change need to be considered. First, the higher frequency of severe weather and resulting dislocations will mean a higher level of vulnerability. Second, the higher rate of job turnover will expose more people to income insecurity.
Skills	Mitigating and adjusting to climate change will have widespread implications for skill development. A high level of innovation will be called for, based on new skills, while the "greening" of existing jobs means that otherwise traditional occupations will need to acquire new competencies. This will in part be induced by changing product specifications, requiring upgraded and new skills for their use and maintenance.
Employment services	Economic restructuring, such as that induced by climate change, typically involves a higher rate of job turnover, i.e. job loss and job creation. Employment services can facilitate labour market transitions through the provision of information on new activities and placement services. As such, they can improve the functioning of the labour market.
Social dialogue	Adapting to change will require the free flow of information, backed by the right to information. Collective bargaining is one effective adjustment mechanism. There will be, moreover, questions of equity and fairness to address. Elaboration of policies in the new area of climate change will require the building of capacity among constituents, and within the Office itself.
Sustainable enterprise	The conclusions on sustainable enterprise from the 96th International Labour Conference provide guidance on the needs of enterprises in the area of sustainability. While these apply to all enterprises, adjusting to climate change will require a particular focus on small and medium-sized enterprises, which dominate enterprise activity in the world economy, are likely to face significant information deficits relative to large firms, and also face more financial constraints than large firms.
Occupational safety and health	Not all green jobs can be defined as decent work, e.g. waste recycling, shipbreaking, work on plantations, other activities in the informal economy. Promotion of green activities in these sectors and elsewhere will require a focus not just on adequate incomes, but on occupational safety and health, and the international labour standards concerned.
Informality and poverty reduction	Much environmental degradation is poverty-driven: reducing poverty through productive employment is thus the route towards greater environmental sustainability. One reason for rising food commodity prices is related to the conversion of food crops to biofuels. Ensuring that greener livelihoods are convergent, rather than divergent, food security and poverty reduction should therefore be an essential focus of policy intervention and action.
Crisis	The increasing frequency of severe weather events requires immediate intervention on the communities and livelihoods that natural calamities disrupt. The focus on crisis prevention is also highly relevant to climate-related adaptation strategies, such as the construction of reinforcements in exposed coastal areas.
Standards and rights	There is both a socio-economic and a gender dimension to climate change. The poor are most vulnerable to the impact of climate change: their health is most at risk, and they work in sectors (e.g. agriculture) that are the most exposed to the negative consequences of climate change. Women are likely to constitute a disproportionate share of those affected. Also, as noted, adjusting to climate change crucially involves standards relating to occupational safety and health.

The ILO's green jobs initiative: Where we are

54. During 2007, the ILO stepped up work on green jobs. The Director-General's report to the International Labour Conference that year highlighted the importance of ILO constituents working together to anticipate the employment changes that a more environmentally sustainable development will engender. [13]

55. The ILO, together with UNEP, the International Trade Union Confederation (ITUC) and the IOE, have set in motion a "Green Jobs Initiative". It looks at the adjustment needs of enterprises and workers affected by the shift towards sustainable production and consumption patterns. Work to date under the Green Jobs Initiative includes:

- A Green Jobs report, produced by the Worldwatch Institute at the initiative of UNEP, the ILO, the IOE, and the ITUC.
- UN Secretary-General Ban Ki-moon has made the UN contribution to addressing the climate change challenge one of three priorities for the UN system. A UN system-wide strategy was presented at the climate talks in Bali in December 2007. It includes the ILO's role in responding to the employment and income implications of climate change and explicitly acknowledges the ILO constituents as important actors in tackling climate change.
- Assessing labour market impacts: an analysis of methodological options. A first application is planned as part of a larger UN project in China in which the Office is involved.
- An initial background study on energy efficiency in buildings in developing countries and emerging economies is under way, with an initial focus on South Africa.
- Energy efficiency and SMEs – research and integration of results into ongoing programmes on enterprise development.
- Skills development: a preliminary review has been carried out for the report on skills discussed at the International Labour Conference in 2008, and a major report on this subject will be prepared for 2009.
- Adaptation to climate change – impacts on rural areas. Together with the FAO, the ILO plans to develop a methodology to factor employment into national plans and programmes for adaptation to climate change. Bangladesh will be one of the countries where the methodology will be tested.
- Bioenergy and smallholder farming: the ILO has been developing tools to assess the employment and income impacts of biofuels in Brazil. It has also been requested to assist the Government of the State of Bahia with the design of a sustainable biodiesel programme to improve livelihoods of smallholder farmers. The programme includes the definition of criteria and indicators on economic, social and environmental sustainability to monitor policy impacts and certify products for marketing and trade.
- Documentation of good practices: a study on the role of the social partners in the implementation of the Kyoto Protocol in Spain has been completed. Other case studies related to the role of social dialogue and to green jobs for development are under way.

[13] Decent Work for Sustainable Development, ILC 96-2007/Report I(A), http://www.ilo.org/public/english/standards/relm/ilc/ilc96/pdf/rep-i-a.pdf.

- Together with the ILO International Training Centre in Turin, a first training module on green jobs will be developed by the end of 2008. It will be primarily aimed at building the capacity of ministries of labour, employers' organizations, and trade unions to bring green jobs strategies into Decent Work Country Programmes.

- "Green Jobs for Asia and the Pacific" is a programme which the ILO is rolling out as a contribution to a focus on "green growth", spearheaded by UNESCAP. A regional research conference on green jobs held in Niigata, 21–23 April 2008, brought together about 40 experts drawn from national and local governments, employers' and workers' organizations, labour research institutes, academia, environmental and social NGOs. The Conference helped to define an agenda for policy-relevant research by ILO and partners in the region, and identified approaches for promoting green jobs, which can be built into ILO Decent Work Country Programmes in the region.

- The ILO's Regional Office for Asia and the Pacific has planned green jobs pilot projects in three countries – Bangladesh, India and China. Additionally, constituents from other countries in the region wish to see a green jobs component within Decent Work Country Programmes.

- The conclusions of the above meeting were translated into a number of messages for the G8 meetings in 2008 in Japan. The ILO's own contribution to the Niigata G8 Meeting of Labour and Employment Ministers in May 2008, at their request, was entitled, "Global challenges for sustainable development: strategies for green jobs". The present paper before the Committee is an adaptation of the ILO's submission to this meeting.

- In Niigata, the Chairperson's conclusions of the G8 Ministers of Labour and Employment Meeting observed: "We note the interesting and potentially valuable work of the ILO in its Green Jobs Initiative, which proposes a coherent, tripartite way of addressing these challenges." [14]

56. The Committee may wish to discuss the interrelation between the Decent Work Agenda and efforts to adapt to and mitigate climate change.

57. The Committee may wish to discuss what the role and modalities of the ILO and tripartism can be in contributing with constituents to their efforts to achieve a low-carbon, poverty reducing, job-rich, and sustainable growth path.

Geneva, 16 October 2008.

Submitted for debate and guidance.

[14] Chairperson's conclusions, G8 Labour and Employment Ministers Meeting, Niigata, 11–13 May 2008, p. 10.