



PROMOTING SAFETY AND HEALTH IN A GREEN ECONOMY



International
Labour
Office



**WORLD DAY FOR SAFETY
AND HEALTH AT WORK**
28 April 2012


SafeWork

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Supported by the International
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**World day for safety and health at work:
28 April 2012**

**Promoting SAFETY and HEALTH
in a green economy**

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A safe and just transition? Global challenges for sustainable development

The 21st century faces two defining challenges: The first is to avert dangerous climate change and the deterioration of natural resources which would seriously jeopardize the quality of life for present and future generations. The second is to ensure sustainable development is built upon three key dimensions: economic growth, social equity and environmental protection.

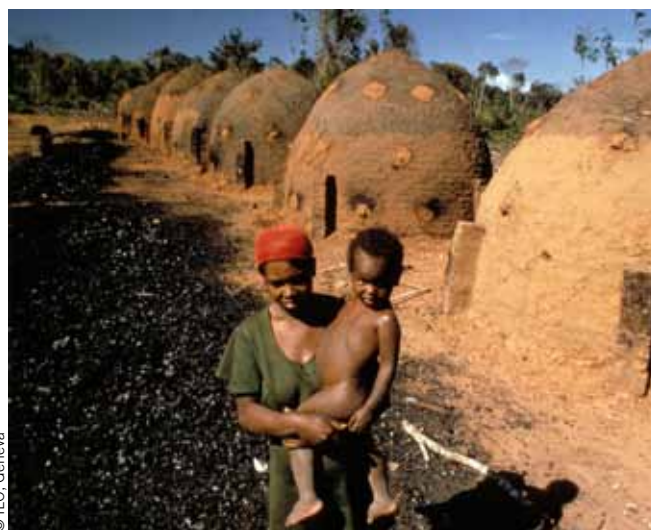
The “green economy” has become an emblem of a more sustainable economy and society that preserves the environment for future generations, and is more equitable and inclusive of all people and all countries. As a result, the advance towards a “green economy” creating “green jobs” and “greening” current industries, production processes and jobs has become a key element for achieving environmentally sustainable economic and social development. In this context, social inclusion, social development and environmental protection should be closely linked to safer and healthier workplaces and decent work for all.



Crisis debate

The *Green Jobs Initiative* is a joint initiative of the United Nations Environment Programme (UNEP), the International Labour Organization (ILO), the International Organization of Employers (IOE) and the International Trade Union Confederation (ITUC)¹. It supports concerted efforts by governments, employers and trade unions to promote, in a climate-challenged world, environmentally sustainable and coherent policies, and effective programmes that are also aimed at generating green jobs and decent work for all.

The *Green Jobs Initiative* calls for a ‘fair and just transition’ whereby those affected by the changes are adequately assisted, and the new opportunities created are shared by employers and workers and their organizations, other social actors and communities. New and



A mother and child are standing in front of coal-making ovens.

more integrated policies are required to develop sustainable enterprises, boost employment creation, enhance workers’ education and skills, improve social security measures, and ease the transition process. In this context, tripartite social dialogue and collective bargaining play an important role. Attention also needs to be given to the gender aspects of this transition to ensure that women and men are granted equal opportunities in the creation of green jobs.

The Green Jobs Initiative defines green jobs² as follows:

Decent work which contributes directly to reducing the environmental impact of enterprises, economic sectors or the economy as a whole by reducing energy and resource consumption, reducing emissions, waste and pollution and by preserving or restoring ecosystems..... Green jobs need to be decent work; i.e. good jobs which offer adequate wages, safe working conditions, job security, reasonable career prospects, and worker rights.”

According to this definition, any work, including “green work”, must adhere to the principles governing workers’ safety and health as they are essential indicators of Decent Work. By highlighting the employment dimension and ensuring the introduction of the concept of Decent Work in the definition of green jobs, the ILO reaffirms that “Decent Work is Safe Work.”³ Therefore, the protection for workers’ health and safety and the protection of the environment should be intrinsically linked to ensure a comprehensive approach to sustainable development. A safe and healthy working environment and the protection of the general environment are often two sides of the same coin. Measures to reduce the adverse impact of the workplace on the general environment can also protect local communities. Likewise, when incorpor-

ating measures to protect the environmental impact of production processes, workers' health should be taken into account. The application of occupational safety and health (OSH) measures is a major contribution to "greening" enterprises and the economy.

"The mounting cost of energy-intensive production and consumption patterns is widely recognized. It is timely to move towards a high-employment, low-carbon economy. Green jobs hold the promise of a triple dividend: sustainable enterprises, poverty reduction and a job-centred economic recovery."

Juan Somavia, Director-General, ILO



Workers tilling their rice fields

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The green debate and its social dimension

The expansion to a green economy is likely to resemble no other transition in human history. The growing perception that the degradation of the climate and the environment is threatening the survival of humanity has triggered a search for alternative economic models, such as the "green growth paradigm" and what it means for job creation, economic recovery and growth.

Despite progress, it has become apparent that a global economy based on the current patterns of consumption and production is placing a heavy burden on many ecosystems and on critical life-support systems. International debate is focusing on a shift towards a green economy as a pathway to sustainable development, integrating three dimensions: ecological, economical and socio-political. A Conference on Sustainable Development (UNCSD), also known as Rio+20, which will take place in June 2012 in Brazil, will focus on two themes: A green economy in the context of sustainable development and poverty eradication; and the institutional framework for achieving such sustainable development.

The ILO has been participating in the Rio+20 preparatory process to ensure that the course of action to achieve sustainable development will include a strong social dimension through better compliance with the ILO's international labour standards and values such as Decent Work, fair employment, and workers' protection. The ILO is focusing in particular, on:

- Reinforced joint efforts for an economically efficient, socially just and environmentally sound transition to a green economy;
- Green jobs creation and the promotion of sustainable enterprises;
- The development of an institutional and political "Just Transition" Framework;
- The extension of social protection systems and the promotion of social inclusion in green economy policies;
- The inclusion of workers' and employers' organizations and labour market institutions in governance and implementation mechanisms;

The creation of green jobs is led by entrepreneurship and innovation. Governments, businesses, workers and their organizations will play a key role in ensuring that the framework and the actions taken lead to a sustainable green economy. In their contribution to Rio+20, the business sector acknowledges the need for a "Just Transition" and recognizes its shared responsibility in the process; the international trade union movement stresses the importance of workers' and trade unions' participation in the shaping of sustainable development policies. They refer to the important role that trade unions play in facilitating a "Just Transition" towards a more sustainable economic model and to the promotion of socially-responsible economic development, social equity and Decent Work. The right to information, education and training, at all levels, including the workplace, are considered paramount to strengthening workers and trade unions' capacity to support sustainable development. Both developed and developing countries should benefit from this transition taking into consideration available local resources and needs.

The shades of green in green jobs

The notion of a green job is not absolute since there are various "shades" of green within which there are thresholds defining the degree aimed for environmental improvement. This is a concept in constant evolution as we strive towards a green economy.

Originally, only those jobs involved in the protection of biodiversity and the environment were regarded as "green". More recently, this notion has been broadened to include the creation of jobs contributing to resource

efficiency and low-carbon development in green sectors, as well as occupations which play a central role in “greening” industries across the economy.

Most studies on green jobs indicate that the main areas of economic activity that have the best potential for generating new green jobs are: renewable energy, construction, transport, recycling, forestry and agriculture. Initially, growth in these areas has been documented mainly in industrialized and some emerging economies, such as Brazil and China; however, it has been spreading to other emerging and developing countries in recent years.⁴ Green jobs include new job opportunities across a wide spectrum of occupations, from managers and scientists to technicians and farmers, and for a wide range of job seekers in rural and urban populations, including slum dwellers.

A shift towards a green economy implies a drastic change in the prevailing development paradigm which requires, in turn, broad social support. Contrary to previous “revolutions”, the policy responses, this time, cannot be purely technological or economical in nature. Enhancing the well-being of the world’s popula-



Orchid nursery

Green jobs and occupational risks

Technological progress and economic development have always been dependent on the availability of cheap energy sources. Today’s production and transport systems would not exist without their high reliance on fossil fuels. It is now widely recognized that the level of greenhouse gases (GHG), such as carbon and methane, affects the earth’s atmosphere and is an important factor in observed climate changes. Fast changing technologies, the present economic and employment downturns, demographic trends, as well as climate change and energy constraints, are contributing to a strong drive towards developing economic activities and jobs that have lower energy consumption and a smaller environmental footprint. However, there is a risk that in the process of creating green jobs, emerging and new occupational risks are overlooked. Recent investment in environmentally-friendly technology for creating “green jobs” has raised concerns about insufficient attention being given to occupational risks in such jobs, and therefore, the need to integrate safety and health measures in designing green jobs. Even if certain jobs are considered to be “green”, the technologies used may not be “green” at all. While in general, “green” technologies are likely to decrease the risk of harmful exposures to the environment, such changes need to be carefully considered prior to implementation. The replacement of some substances harmful to the environment by more environmentally-friendly ones have proven to be more hazardous to workers’ health. For example, the substitution of solvent-based for water-based paints has included the addition of biocides. The substitution of hydro-chlorofluorocarbons for chlorofluorocarbons has increased the risk of exposure to carcinogens, as well as to fire hazards.



Waste-processing centre

tion must be part and parcel of achieving sustainable development. This change of paradigm implies that, while environmental risks are to be curbed, social equity and human well-being must be enhanced.

For that reason, the occupational safety and health dimension becomes an important factor in today’s green economy debate. Awareness on the impact of new and emerging risks⁵ linked to green jobs is necessary. There is an unprecedented opportunity to guarantee, from the onset that green jobs are safe and healthy for workers and at the same time, they minimize negative impacts on the environment and communities. The incorporation of preventive and control measures at the design stage, is crucial to eliminate occupational hazards and risks associated with “green” technologies.

Any human economic activity involves a balance between risk and benefit where, depending on the nature of the activity, the risk can range from mere material wealth loss to harm to health or loss of life. Whether it is green or not, work will always generate risks of accidents and diseases, the reduction and elimination of which rests on the fundamental principles of OSH. The application of OSH regulatory systems does not depend on the “colour” of the job. For all workplaces and jobs, whatever the “shade of green”, employers must ensure safe and healthy working conditions and environments for their workers. In that sense, the technologies and processes in green jobs must be the object of hazards and risks assessment and management as for any other job, preferably in their design and pre-operational phases. These assessments are also an effective way to determine if a technology which has been labelled as “green” has no or minimal negative impact on the environment.



Iron scrap collector

The assessment of the occupational hazards and risks that might be associated with new “green” technologies and related jobs, well before they become part of the economic fabric, is now becoming part of the discussion. While these jobs are meant to help improve the environment, revitalize the economy and create new employment opportunities, one of the greatest risks is that, in the haste to create these new jobs in large numbers, little attention is paid to their quality and to the fact that the incidence of occupational injuries and diseases, or even death, might increase before adequate protective measures are in place. Workers in green jobs may face hazards that are commonly known in traditional workplaces. These hazards may be new to many workers who are moving into fast-growing “green” industries. Additionally, workers may be exposed to new hazards, which may not have been previously identified. For example, workers in the solar energy industry may be exposed to cadmium telluride (a known carcinogen) if adequate controls are not implemented. This is why, at this stage, it is increasingly important to ensure that the process of green jobs’ creation integrates upstream prevention strategies designed to anticipate, identify, evaluate and control emerging hazards and risks arising from these jobs.



Waste-processing centre

With the overall aim of investigating new types of risks related to green jobs generated by new technologies, in 2011, the European Risk Observatory (ERO) of the EU-OSHA published the first of a series of studies on *Foresight of New and Emerging Risks to Occupational Safety and Health Associated with New Technologies in Green Jobs by 2020*.^{6,7} These studies intend to provide the EU social partners with elements to make decisions regarding OSH issues as they may arise in the future. The primary interest focuses on people working with, or directly affected by, the new technologies. Combinations of new and emerging risks are of interest, for example, in the installation of solar panels, where electrical risks are combined with the risk of working at heights.

Occupational risks in renewable energies

Fuelled by sustained public support, expanding investment flows and growing production capacities, employment in renewable energy is growing at a rapid pace, and this growth seems likely to accelerate in the years ahead. Renewable energy creates more jobs per unit of installed capacity, power generated and dollar invested, than fossil-fuel power stations. Overall, a conservative estimate of the number of people presently employed in the renewable energy sector runs to about 4.2 million globally. Half of these jobs are in biofuels, mostly in growing and collecting feedstock, but also in processing industries. With the rapidly rising interest in energy alternatives, future years may well see worldwide employment soar, possibly as high as 20 million by 2030.⁸ Projections for individual countries indicate a strong potential for job creation in the coming years and decades. Germany, Japan, China, Brazil and the United States play particularly prominent roles in renewable technology development, and, so far, they have gathered the bulk of jobs in the renewable energy sector worldwide. European manufacturers account for more than three-quarters of global wind turbine sales. India however, is also a major force in the



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Installation of solar panels

renewable technology sector. Renewable energies include solar energy, wind energy, hydropower, bioenergy, marine wave and tidal energy, and geothermal energy. Solar, wind and biomass energies are the most commonly used, and are described below.

Solar energy

Solar energy can be converted into electricity using Photovoltaic (PV) panels, or concentrating solar power (CSP). PV systems are the most common and use semi-conductors and sunlight to make electricity. Occupational hazards exist in the manufacturing, installation and eventually end of life waste disposal of PV panels. More than 15 hazardous materials are used in the manufacture of PV panels.⁹ Many hazards may arise from the chemicals used in conjunction with silicon in various manufacturing processes. PV cell manufacture also involves a number of cleaning agents which may be toxic. Consequently, workers involved in manufacturing photovoltaic modules and components must be protected from exposure to these materials. Solar PV panels have the potential to create a significant new wave of electronic waste at the end of their useful lives (which is estimated to be 20 to 25 years), and they also contain a growing number of new and emerging materials, (such as cadmium telluride and gallium arsenide) that present complex recycling challenges in terms of technology, safety and health and environmental protection.



© United Nations

Mongolian family uses solar energy to power home

Some physical hazards that workers face when installing solar panel systems are similar to those in construction, but are new to electricians and plumbers installing PV panels or solar water heaters on roofs. These may include falls from heights, manual handling, high temperatures, confined spaces and electrocution during construction and maintenance; there is an additional health hazard for fire-fighters and residents from fumes released from burning photovoltaic modules in case of fire in buildings.

Concentrating Solar Power uses the sun's rays to heat a receiver which creates mechanical energy to generate electricity, as opposed to PV, which uses direct conversion with semi-conductors. Occupational hazards in CSP are embedded in the construction and maintenance of industrial scale installations, such as electrical hazards, high temperatures and hazards from concentrated sunlight.

Wind energy



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Wind power generation has seen tremendous growth over the past decade and continuing growth is expected. The types of jobs include project development, turbine component manufacturing, construction, installation, operation and maintenance of wind turbines.

The type of hazards and risks in the manufacture of windmills are similar to those in the automobile industry and aerospace installations, while hazards and risks concerning their installation and maintenance are similar to those in construction. Workers may be exposed to chemical hazards from exposure to epoxy resins, styrene and solvents, harmful gases, vapours and dusts and physical hazards from moving parts, as well as manual handling in blade manufacturing and maintenance. There is a risk of exposure to dust and fumes from fibreglass, hardeners, aerosols and carbon fibres. Common health related problems include dermatitis, dizziness, sleepiness, liver and kidney damage, blisters, chemical burns, and reproductive effects. Physical hazards during maintenance, are include: falls from heights, musculoskeletal disorders from man-

ual handling, and awkward postures when working in confined spaces, physical load from climbing towers, electrocution, and injuries from working with rotating machinery and falling objects. Numerical estimates on accidents, injuries and diseases are uncertain due to a lack of available statistical data and because of the different production techniques used by different wind turbine manufacturers.

Hydropower

Hydropower produces electricity without using fossil fuels, and is consequently not part of the emissions caused by electricity production in coal, oil, or gas fired power plants. The environmental impact of hydropower is related to the damming or lowering of the water level, changes in water flow and building of dams, roads and power lines.

Hydropower currently provides more than 17 per cent of the world's electricity, making it, by far, the most important renewable energy for electrical power production. The contribution of small-scale hydropower to the world's electrical capacity is similar to the other renewable energy sources and about 53 per cent of this capacity is in developing countries.¹⁰

Small-scale hydropower is, in most cases, any small dam or hydraulic structure which stores very little or no water. Therefore, these installations do not have the same kind of adverse effects on the local environment as do large hydropower stations. Hazards and risks associated with the construction, operation and maintenance of large hydropower stations are those related to the construction industry and to electric power transmission and distribution. They include injuries from mechanical equipment and material handling, electrical hazards from unexpected electrical energy release from overhead and underground lines installation or construction in energized substations, chemical exposures from sulphur hexafluoride gas and polychlorinated biphenyl. Workers should be provided with protective equipment including lineman's body belts, safety straps, and lanyards, respiratory protection and electrical protective equipment. Procedures for emergency response should be in place. Frequently, serious accidents take place during the construction of large-scale dams. These installations can also have a serious social impact if local communities and indigenous peoples are displaced.

Bioenergy

Bioenergy is developing fast, and includes liquid bio-fuels, biogas and modern biomass for heating and power generation. Future technological development of bio-fuels will take into account a wider range of feedstock for bio-ethanol and bio-diesel, such as algae, jatropha and curcas (monocrops) and used cooking oil/animal fats. One major social concern is the impact of using

land to grow energy crops. Bio-fuels are under increasing scrutiny from researchers and environmentalists for contributing to rising food prices, for the loss of biodiversity and for failing to reduce overall carbon emissions. How serious these impacts are will depend on how carefully the resource is managed, on the type of bio-energy technology used and the wide variety of production and conversion methods, each with different environmental impacts.

Whether in solid, liquid, or gas form, bio-energy also raises OSH and environmental concerns. Hazards are mostly associated with feedstock production and are similar to those in agriculture and forestry. The production of traditional feedstocks, like sugar cane or soybean can be associated with exposure to agro-chemicals. Manual harvesting of sugar cane also involves heavy physical loads in typically hot and humid environments. In extreme cases, this can result in death through heat exhaustion. During thermal processing, there is exposure to carcinogens, gases, carbon monoxide, sulphur oxides, lead, volatile organic compounds (VOC) and trace quantities of mercury, heavy metals and dioxins. The amount of pollution emitted per unit of energy generated varies widely depending on the technology. In storage, biomass presents a fire risk when dry and the material used for biomass processes does not always store well; there is also a risk of explosion when small particles are dispersed in the air. Biomass can also produce local air pollution, spores and foul liquids which may have the potential to affect health, consequently careful handling and containment measures are required. The safety issues arising from the downstream aspects are generally very similar to equivalent processes from fossil resources. For example, requirements for the safe operation of gas turbines, safe storage, handling and transportation of flammable liquids, are well known.

The provisions and guidance provided by key ILO standards and codes of practice are highly pertinent to the anticipation, identification, assessment and control of hazards and risks, whether known or new, arising from green technologies and jobs.¹¹

- **Occupational Safety and Health Convention (No. 155) Recommendation (No. 164), 1981**
- **Protocol of 2002 to the Occupational Safety and Health Convention (No.155), 2002**
- **List of Occupational Diseases Recommendation (No. 194), 2002**
- **Occupational Health Services Convention (No.161) and Recommendation (No.171) , 1985**
- **Promotional Framework for Occupational Safety and Health Convention (No. 187) and Recommendation (No. 197), 2006**
- **Guidelines on Occupational Safety and Health Management Systems (ILO-OSH 2001), ILO, 2001**

Waste management and recycling

Recycling will be an increasingly integral part of product design and waste management. However, new recycling technologies may introduce new risks as there will be greater emphasis on advanced processes to preserve the performance qualities of materials. Also, new materials and products, when being collected as waste, may present a variety of occupational risks from nanomaterials and new types of chemicals to the continuous growth in electronic waste. In addition, waste disposal is turning into a new branch of the energy sector where waste-to-energy processes can generate hazards from impure gas production, explosions, dangerous substances and gases in confined spaces. Future landfill mining for valuable resources will increase exposures to harmful materials.



© ITUC/Hazards magazine

Waste management systems are complex, involving both private and public sectors. The ILO's green jobs programme identifies waste management as one of the fastest growing sources of green employment. However, many waste management jobs, which are green in theory, are not green in practice because of the environmental and human health damage caused by inappropriate practices. Most waste management strategies promote a shift from considering waste as an unwanted burden to viewing it as a valued resource, or to prevent its generation in the first place. Figure 1 provides essential waste hierarchy guidance where prevention is the best option and disposal the last resort.¹²

Recycling work can be dirty, polluting, undesirable, even dangerous, and it is often poorly paid, even in developed countries. A study of working conditions in recycling centres in Sweden, for example, identified several risks and found a high frequency of injuries.¹⁴ It concluded that there is a clear need for preventive actions in several areas, such as better machinery and equipment and more training, especially in handling hazardous waste. Workers at a UK-based electrical waste recycling facility suffered

from mercury poisoning, generated by the recycling of eco-light bulbs containing mercury, due to poor work practices.¹⁵ Another example is scrap metal recycling, which is a vast industry that employs many workers. In the United States common causes of illness in this industry are heavy metal poisoning, repeated trauma disorders, skin and respiratory diseases or disorders.¹⁶

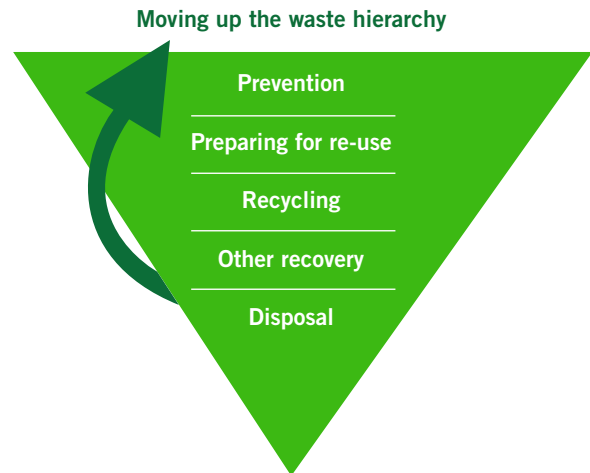


Fig. 1 The Waste Hierarchy (Being wise to waste. European Commission, 2010)¹³

In most developing countries, the ever-increasing quantities of waste have overwhelmed local governments' capacities to cope efficiently. Very often, infectious medical waste and toxic industrial waste are not separated from domestic waste before finishing up on the dump site. Recycling activities are mainly carried out by workers in the informal economy. It is estimated that there are between 15 million and 25 million waste pickers in the world. China, which is the biggest waste generator in the world, employs an estimated 10 million people in this sector.¹⁷ Waste pickers are usually vulnerable, poor people, often women and children, who are continually exposed to hazardous substances, broken glass and pathogens, and are generally not recognized socially or economically. The situation is particularly dramatic for new, complex and hazardous waste flows, like electronic waste.



© ILO, Geneva

Rubbish picking

For waste picking to become a green and decent job, waste pickers need to be able to organize and work in an improved environment, and children should not be allowed on disposal sites. By training workers, rearranging the disposal layout, implementing modest sorting facilities, providing protective equipment, water supply for washing and sanitation, and hygiene education, the waste pickers could have better working conditions and health risks would decrease. Allowing only registered adults on dumpsites is also recommended. The implementation of simple OSH measures, as a first step, would provide the easiest entry point for the extension of basic labour protection for this group of operators from the informal economy.

Shipbreaking

Currently, 90 per cent of shipbreaking in the world is carried out in Bangladesh, China, India, Pakistan and Turkey. The shipbreaking industry has become an essential part of the economy for these countries, since it is labour-intensive, and it is a major source of employment. As it recycles metal and reduces the need for mining and production of raw metal, the shipbreaking industry could be classified as a potential source of “green jobs”. However, due to the characteristics of the ships and the highly polluting materials they carry, shipbreaking activities are sources of serious environmental and occupational health hazards. Inadequate working conditions prevail and efficient control mechanisms are lacking. The main hazards associated with shipbreaking include exposure to hazardous substances and wastes, such as asbestos, oils and oil sludge, toxic paints, PCBs, isocyanides, sulphuric acid, lead and mercury. Other hazards and risks include physical, mechanical, biological, ergonomic and psychosocial factors. According to the Basel Convention,¹⁸ old ships should be considered as toxic wastes and a primary requirement is that ships are cleaned from their toxic contents before they are dismantled.

In order to transform shipbreaking into a source of green and decent jobs, it is necessary to promote adequate working conditions and the protection of workers' health and safety through the provision of training, safety equipment, adequate working environments and hygienic living quarters. Formalizing the workforce is also vital for these workers' right to Decent Work. In addition, a global partnership of shipowners, shipbreakers, employers, trade unions and inspection services needs to be developed to enforce global standards. A number of international instruments provide guidance regarding the sound management of shipbreaking activities.

- **International Convention for the Safe and Environmentally Sound Recycling of Ships, IMO 2009¹⁹**
- **Safety and health in shipbreaking: Guidelines for Asian countries and Turkey, ILO, 2004²⁰**

OSH risks in the greening of traditional sectors

Mining and extractive technologies



Coalmine in China

Mining is one of the most hazardous sectors, both in opencast and underground mining. Operations in mining may expose workers to a wide range of hazards that could cause injury, occupational diseases or death; they are not discussed in detail here. However, some of the risks associated with mining and excavation activities include: risk of fires and explosions, electrocutions, exposure to silica dust, mercury, other chemicals and heat. Silicosis is one of the most serious occupational diseases. It is an incurable lung disease caused by the inhalation of dust that contains free crystalline silica. With its potential to cause progressive and permanent physical disability, silicosis continues to be one of the most serious occupational diseases in the world.

The environmental impact of mining practices is well known. Greenhouse enhancing gases, (such as carbon dioxide, methane, and nitrous oxide), the use of fuels, power and water and the possible introduction of contaminants have impacts at different stages of the life cycle of a mine. The environmental and health impact of mercury is most evident in mining regions. When mercury is released, it can travel long distances and be deposited on soil and in lakes.

Optimizing mine planning and mining processes, operations, technologies and equipment through design during the concept and pre-feasibility phases of a mine project allows for incorporating safety and health measures and for assessing the potential environmental impact and prevent it. Such an approach would contribute to a significant increase in the protection of workers' safety and health, and the reduction of greenhouse emissions and contamination. Therefore, health, safety and environmental excellence must be among the key parameters on which corporate governance performance of mining companies should be evaluated.

In many poor rural areas around the world, men, women and children work in artisanal gold mining using mercury to extract the gold from the ore, as it is the cheapest and easiest method available. It is also extremely hazardous. Artisanal small-scale gold mining belongs to the informal economy. Therefore, special measures to protect gold miners from exposure to mercury need to be put in place by providing safer means of gold mining or alternative means of employment for these communities.

The principles of ILO standards and codes of practice and programmes relevant to OSH in the mining sector are also pertinent to the greening of the mining industry.

- **Safety and Health in Mines Convention (No. 176) and Recommendation (No. 183), 1995**
- **Code of practice on safety and health in open cast mines, ILO, 1991**
- **Code of practice on safety and health in underground coal mines, ILO, 2006**

Agriculture

Sustainable agriculture foresees the integration of environmental health, economic viability and social equity, including the management of natural resources. Sustainable agriculture also promotes the reduction in the use, substitution or elimination of agrochemicals such as pesticides, fertilizers, and other agents, as well as the use of soil protection measures like zero-tillage, enrichment with organic matter and water saving irrigation.



Hydroponicagriculture

Organic agriculture eliminates most agrochemicals, and has provided a response to their excessive use and their impact on the health of agricultural workers and consumers and on the environment. Nevertheless, it is

more labour-intensive and often less productive than commercial agriculture. Therefore, both types of agriculture coexist and new technologies have been incorporated into commercial agriculture to reduce the use of agrochemicals, through, for example the use of genetically-modified organisms (GMOs) that make crops resistant to insects.

Even though a reduction in the chemical exposure of farm workers to pesticides has been documented after the incorporation of agricultural biotechnology, little research exists concerning the health and safety implications to workers involved in agricultural production, handling, processing and storage of GMOs. Most regulatory frameworks and research on GMOs concern risk assessment related to food safety and environmental protection.

Although occupational hazards and risks in agriculture are similar, different exposures result from production practices, workers' skills and the knowledge needed to produce or use GMOs as raw materials during the production process of food, fibre, pharmaceuticals, and other future applications of biotechnology and genetic engineering. Risks from these new practices related to higher-valued engineered crops and animals will appear alongside with traditional hazards and risks in agriculture. For example, new types of handling systems will need to be designed to avoid cross contamination of GMO products and to ease cleaning of storage and handling systems. Dust generated by genetically-modified products may cause different reactions when inhaled as compared to traditional crops. Transgenic animal systems will require specialized handling, milking equipment, processing facilities and security systems.²¹

Whether traditional or organic practices are in place, the principles and guidance relevant to OSH in agriculture provided by ILO instruments and manuals are relevant to ensure safe and healthy working conditions and working environments for agricultural workers, farmers and their families, and indigenous peoples.

- **Safety and Health in Agriculture Convention (No. 184) and Recommendation (No. 192), 2001**
- **WIND (work improvement in neighbourhood development) training manual, ILO, 2005.**
- **Ergonomic checkpoints in agriculture, ILO, 2012.**

Forestry work

Deforestation and forest degradation contribute to about 18 per cent of all greenhouse gas emissions, the largest contributors compared to both agriculture and the transportation sector. Occupational hazards and risks in sustainable forest management are similar to that of conventional forestry methods. A key difference



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Deforestation in Brazil

is that sustainable management relies on competent workers and protects them. The development of green jobs in this sector is dependent on the inclusion of decent work requirements in the practice of sustainable forest management. Decent Work standards, including recommendations to use ILO guidance on OSH in forestry, as well as the social concerns of local communities are part of the major forestry certification standards for sustainable forestry (FSC and PEFC). They are now being extended to the downstream value chain in the wood and pulp, and paper industries. Trade unions have consistently campaigned for the inclusion of the principles of ILO international labour standards in certification systems to ensure the protection of workers' rights.

Processes and mechanisms to enable people and communities with a direct stake in forest resources to be part of the decision-making in forest management, such as participatory forestry, are essential in future developments when creating genuine green jobs. A number of ILO publications also provide guidance on safety and health in forestry work.

- Code of practice on safety and health in forestry work, ILO, 1998
- Guidelines for labour inspection in forestry, ILO, 2005

Construction and refurbishment

Buildings are a major contributor to greenhouse gases. Therefore, new constructions that are energy-efficient and the sustainable refurbishment of existing buildings have huge potential for green jobs creation. In the use of resources for the construction of green buildings, ecological and efficiency principles are applied. This entails different technological skills and management

requirements. Energy-efficient construction and sustainable refurbishment require skills development and training far beyond those for traditional buildings. Seven principles for sustainable construction and renovation have been developed by the ILO, taking into account the entire life cycle of a building:²²

- reduce resource consumption
- re-use resources
- use recyclable resources (recycle)
- protect nature, eliminate toxics
- eliminate hazardous chemicals
- apply life-cycle costing (economics)
- focus on quality

Construction is one of the most hazardous sectors. The need for qualified and competent enterprises for green building projects provides a valuable opportunity to upgrade working conditions in this sector, improving, at the same time, OSH competences. Experience demonstrates that without these preconditions, green buildings cannot be constructed; neither can a fraction of their technological and economic potential be achieved.

A green building project may include new green jobs (such as solar panel installations), as well as traditional ones, such as concrete pouring, but often with substantially higher requirements of know-how. Therefore, green construction jobs will have many occupational risks similar to traditional risks in construction, such as walking and working surfaces, work at heights, hand and power tools, electricity, confined spaces, and storage and handling of chemicals. The introduction of new situations (such as the installation of renewable energy equipment at heights, feeds-in to smart grids), combined with the use of new construction materials (such as bricks, insulation materials and paints containing nanomaterials), can also be sources of hazards and risks.



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Solar voltaic panels in Senegal

Exposure to asbestos in demolition and refurbishing is particularly hazardous and it is difficult to control exposure in an absolutely safe way. It requires special protective equipment and training of workers. Only companies or contractors with competencies recognized by national authorities can carry out demolition and refurbishing work. In the future, the construction industry will increasingly use substitutes to ensure the phasing-out and elimination of health risks from exposure to asbestos to be consistent with greening the construction sector and protecting workers' health.



Construction worker reads building blueprint plan

Today, certification programmes for green buildings do not consider workers' health and safety in assessing whether a building is, or is not, green. It is clear that workers are not necessarily safer working on green buildings compared to traditional buildings. It is, therefore, essential to vigorously address these traditional hazards and identify possible new hazards associated with green design elements while assessing the risks to workers' safety and health, and either eliminate the hazards or minimize the risks. Green construction presents an opportunity to address some of the issues and problems that affect construction workers, but this requires commitment. Construction workers who are not unionized or who are migrants are also more likely to be exposed to higher risk.

The greening of the building sector entails changes in the process of production and working conditions; hence, green construction has to incorporate OSH in its standards. Addressing the hazards associated with green construction will require a range of different solutions. Some of these solutions involve social messaging and communications, coupled with training for owners, designers, contractors and workers. Others involve policy changes needed to support approaches such as the Prevention through Design Strategy promoted by the United States Institute for Occupational Safety and Health, (NIOSH).²³ Other strategies to promote safety and health in construction focus on improving voluntary programmes, such as rating programmes for green

buildings. The principles laid out in ILO standards and codes of practice relevant to OSH in the construction sector are also pertinent to the "greening" of the construction sector.

- Safety and Health in Construction Convention (No. 167) and Recommendation (No. 175), 1988
- Code of practice on safety and health in construction, ILO, 1992
- Asbestos Convention (No. 162) and Recommendation (No. 172), 1986
- Code of practice on safety and health in the use of asbestos, ILO, 1984

The special case of nuclear energy

There are different views on whether nuclear power should or should not be part of the future energy mix of a green economy. For many, nuclear power is not considered an environmentally-acceptable alternative to fossil fuels, given unresolved safety, health and environmental issues concerning the operations of power plants and the resulting hazardous, long-lived nuclear waste. Those who support nuclear power emphasize its positive aspects, mostly related to its overall low impact on climate change. During operation, it produces virtually no greenhouse gas emissions or acid gases (such as sulphur dioxide and nitrogen oxides), unlike the burning of fossil fuels (such as coal and natural gas).



IAEA nuclear plant inspection

Regardless of these debates, the fact is that currently over 400 nuclear power reactors are in operation worldwide and the construction of many more is planned.²⁴ In this context, it is critical to reinforce safety and health measures to protect workers and communities. The main sources of potential damage are major accidents and non-routine radiation, and concerns about workers' exposure to ionizing radiations remain high. Nuclear power use raises serious concerns about the



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Fukushima nuclear power plant

security aspects of the industry, such as the potential for nuclear power plant accidents with catastrophic outcomes as in the cases of Chernobyl and Fukushima. The inadequate management of major hazard installations and the lack of technology for long-term management of high-level commercial nuclear waste are still causes for concern. The decommissioning of nuclear power installations and nuclear waste treatment are current problems that will need to be dealt with, whether nuclear power use is phased out or increased in the future. Consequently, the principles of OSH management concerning major hazard installations should prevail. Furthermore, the principles of ILO standards and codes of practice relevant to the protection of workers from ionizing radiations are also pertinent for the nuclear energy sector.

- **Radiation Protection Convention (No.115) and Recommendation (No. 114), 1960**
- **Occupation Cancer Convention (No.139) and Recommendation (No. 147), 1974**
- **Code of practice on radiation protection of workers (ionizing radiations), ILO, 1987**
- **Radiation protection and safety of radiation sources: International basic safety standards-interim edition-IAEA, 2011**
- **Radiation protection of workers, Information Note Series No. 1, SafeWork, ILO, 2011**

The way ahead

Building a green economy is a necessary and hopeful response to the conjunction of a global economic downturn, high unemployment, increasingly alarming climate changes, general environmental degradation and dwindling resources, including potable

water. However, success in the transition process from a mainly fossil-fuel driven economy to one that is sustainable and environmentally sound will require strong and, ideally, global political commitment and coordinated actions.

In the view of the ILO, a transition towards a green economy needs to project a vision of a greener, but also of a fairer, economy and society. This way, it can lead to net gains in decent employment by creating of new jobs and upgrading many existing and traditional ones across the economy, and, at the same time, protecting workers' health and the environment. However, a green economy is not socially fair, inclusive and sustainable by default. Coherence between economic, social, labour and environmental policies is needed to maximize opportunities and buffer the social cost of the transition. The key to success will be the integration of social equity and well-being in the process.

As the green economy develops, it is critical that the safety and health of workers are integrated into policies for the creation of green jobs. The current focus on the transition to a low carbon economy should look at complex environmental problems from a multidisciplinary approach, integrating environmental aspects with occupational safety and health and public health, while, at the same time, taking into consideration the well-being of surrounding communities.

As many of the original hazards persist, and in some sectors they are exacerbated by new technologies and working conditions, green jobs today do not necessarily translate into decent jobs and improved environmental outcomes. Therefore, integrating the OSH dimension implies evaluating the hazards and risks to workers in all green jobs, processes and products through the implementation of risk assessment and management measures. A true green job must integrate safety and health into design, procurement, operations, maintenance sourcing, use, re-use and recycling policies and decision-making. A first step could be to integrate safety and health into rating, index validation and certification systems, and to enforce OSH quality standards in green jobs. Another important aspect to consider is a life cycle analysis of green jobs, looking at all aspects and impacts of the job and supply chain, and not only at its climate change neutrality. This is especially relevant for sectors such as construction, waste recycling, solar energy production and biomass processing.

The transition towards a green economy and greener workplaces can become a major driver for the broader application of labour standards through a combination of awareness raising, the participation of employers and workers and their organizations, regulation and enforcement. This can be further enhanced in corporate governance and social responsibility processes. In ensuring this, labour inspection systems, em-



Middelgrunden offshore wind farm in Denmark

Moving towards a green economy implies setting higher standards for environmental protection and for the creation of green jobs whilst, at the same time, incorporating workers' safety and health as an integral part of the strategy. Only then, will we be contributing to an environmentally sustainable and socially inclusive outcome, only then, will we achieve *safe, healthy and decent work in a green economy*.

ployers and workers and their organizations play a key role. For example, account should be taken of the importance of social dialogue and collective bargaining on OSH issues in this transition. In addition, representatives from government, industry and employers' and workers' organizations, which are involved in the technical and human resource requirements, as well as in the economic and social implications of green jobs policies, should actively participate in their design, implementation and monitoring to incorporate the safety and health of workers and maximize the benefits in terms of decent employment.

The ILO Decent Work Agenda and the numerous standards on safety and health promote universal principles which are pertinent to any type of economic system or workplace and contribute to sustainable development. Furthermore, some of the OSH standards are also relevant to the protection of the environment. They are, therefore, particularly important in relation to how green jobs can become examples of safer, healthier and decent jobs.

"The working environment is an important and integral part of the human environment as a whole, and the factors that harm the working environment are also among the major pollutants of nature and of people's living environment."

Resolution concerning the Contribution of the International Labour Organization to the Protection and Enhancement of the Environment Related to Work, ILO, 1972.



Haiti agriculture

Notes

- ¹ Green Jobs Initiative: United Nations Environment Programme, the International Labour Organization, the International Organization of Employers and the International Trade Union Confederation, see http://www.unep.org/labour_environment/features/greenjobs-initiative.asp (accessed 10/01/2012).
- ² Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World, UNEP/ILO/IOE/ITUC, September 2008 - http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf (accessed 13/01/2012).
- ³ ILO: Promoting decent work in a green economy, ILO background note to United Nations Environment Programme report entitled "Towards a green economy: pathways to sustainable development and poverty eradication", Geneva, 23 February 2011.
- ⁴ Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World, UNEP/ILO/IOE/ITUC, September 2008 http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf (accessed 13/01/2012).
- ⁵ Emerging occupational risks can be both "new" and "increasing". By "new" it means that the risk did not previously exist and is caused by new processes, new technologies or social or organizational change; a long-standing issue can also be considered as a new risk due to a change in public perception or new scientific knowledge. The risk is "increasing" if the number of hazards leading to the risk is growing, the likelihood of exposure to the hazard leading to the risk is increasing or the seriousness of the effects of the hazard on workers' health is rising.
- ⁶ P. Ellwood, S. Bradbrook, J. Reynolds and M. Duckworth: "Foresight of new and emerging risks to occupational safety and health associated with new technologies in green jobs by 2020 - **Phase 1**- Key drivers of change", European Agency for Safety and Health at Work, 2011. This report was commissioned by the European Agency for Safety and Health at Work (EU-OSHA) <http://osha.europa.eu/en/publications/reports/foresight-green-jobs-drivers-change-TERO11001ENN>
- ⁷ P. Ellwood, S. Bradbrook, J. Reynolds and M. Duckworth: "Foresight of new and emerging risks to occupational safety and health associated with new technologies in green jobs by 2020 **Phase 2** – Key technologies", European Agency for Safety and Health at Work, 2011. This report was commissioned by the European Agency for Safety and Health at Work (EU-OSHA) <http://osha.europa.eu/en/publications/reports/foresight-green-jobs-key-technologies>
- ⁸ Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World, UNEP/ILO/IOE/ITUC, September 2008 - http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf (accessed 13/01/2012).
- ⁹ For a hazard's classification of chemicals typically used in PV module manufacturing according to the US Department of Transportation see: EPRI and CEC: Potential Health and Environmental Impacts Associated with the Manufacture and Use of Photovoltaic Cells, EPRI, Palo Alto, CA, and California Energy Commission, Sacramento, CA, 2003.
- ¹⁰ Small hydropower for developing countries, European Small Hydro-power Association (ESHA). http://www.esha.be/fileadmin/esha_files/documents/publications/publications/Brochure_SHP_for_Developing_Countries.pdf , (accessed on 22/01/2012).
- ¹¹ All ILO instruments related to OSH are available in full text on the ILO's web site. See <http://www.ilo.org/safework/normative/lang--en/index.htm>.
- ¹² Being Wise with Waste: The EU's approach to Waste Management, European Commission, 2010, <http://ec.europa.eu/environment/waste/pdf/WASTE%20BROCHURE.pdf> (accessed 22/01/2012).
- ¹³ *ibid*
- ¹⁴ I. Engkvist: "Working Conditions in Recycling Centres in Sweden – Physical and Psychosocial Work Environment" in *Applied Ergonomics* (2010), Vol. 41, No. 3, p.347-354.
- ¹⁵ First Lead, now mercury makes a toxic comeback, ITUC, Hazards Magazine, 2009, <http://www.hazards.org/greenjobs/blog/2009/11/24/first-lead-now-mercury-makes-a-toxic-comeback/> accessed (11/01/2012).
- ¹⁶ Guidance for the Identification and Control of Safety and Health Hazards in Metal Scrap Recycling, OSHA, 2008, <http://www.osha.gov/Publications/OSHA3348-metal-scrap-recycling.pdf> accessed (13/01/2012).
- ¹⁷ Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World, UNEP/ILO/IOE/ITUC, September 2008 - http://www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf (accessed 13/01/2012).
- ¹⁸ Technical Guidelines for the Environmentally Sound Management of the Full and Partial Dismantling of Ships, Basel Convention of UNEP, ILO, SafeWork, 2003, http://www.ilo.org/safework/info/publications/WCMS_117942/lang--en/index.htm (accessed 13/01/2012).
- ¹⁹ International Convention for the Safe and Environmentally Sound Recycling of Ships, IMO, 2009, <http://www.imo.org/about/conventions/listofconventions/pages/the-hong-kong-international-convention-for-the-safe-and-environmentally-sound-recycling-of-ships.aspx> (accessed 13/01/2012).
- ²⁰ Safety and health in ship breaking: Guidelines for Asian countries and Turkey, ILO, SafeWork, 2004, http://www.ilo.org/safework/normative/codes/WCMS_107689/lang--en/index.htm (accessed 13/01/2012).
- ²¹ Shutske JM, Jenkins SM. "The impact of biotechnology on agricultural worker safety and health". *Journal of Agricultural Safety and Health*. 2002 Aug;8(3):277-87.
- ²² Green Jobs Creation through Sustainable Refurbishment in the Developing Countries, ILO, Sectoral Activities Department, 2010, http://www.ilo.org/sector/Resources/publications/WCMS_160787/lang-en index.htm (accessed 13/01/2012).
- ²³ Prevention Through Design: Plan for the National Initiative, CDC, NIOSH Publications and Products, 2011-121, <http://www.cdc.gov/niosh/docs/2011-121/> (accessed 16/01/2012)
- ²⁴ World Nuclear Power Reactors & Uranium Requirements <http://www.world-nuclear.org/info/reactors.html> (accessed 20.02.2012)





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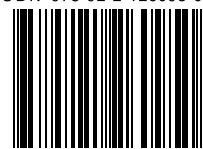
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